The Welding Engineer

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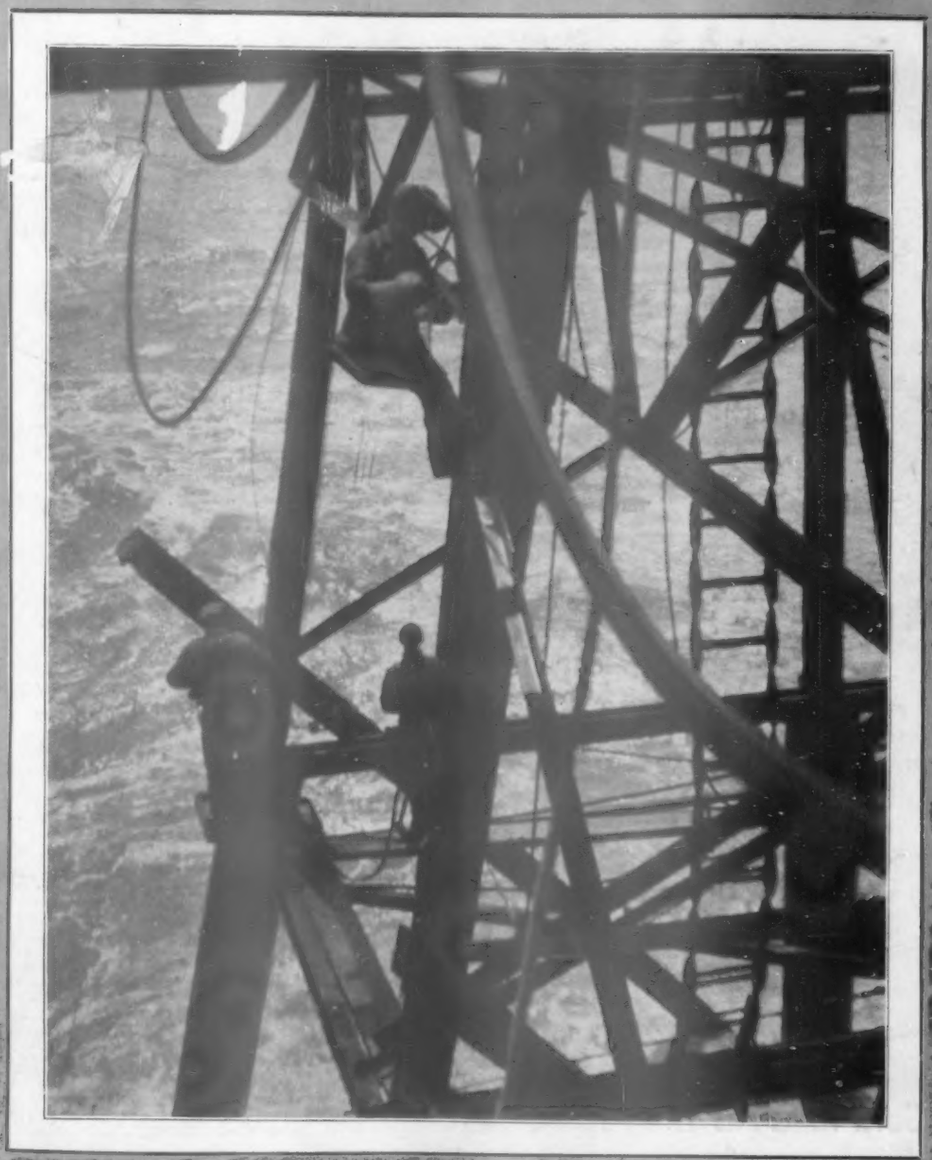
me 20 January, 1935 Number 1



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(See Page 22)

oneer Business and Technical Journal of the Welding Industry

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THE WELDING ENGINEER

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Buick Motor Div. Dept. of
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9-24-1940

· E D I T O R I A L ·

Copper Was a Wall-Flower Until—

● For a great many years, copper carried the handicap of not being a material easy to weld. The coppersmith used spelter rather than try to weld the material, and when welding was attempted it was limited to the deoxidized product. Ordinary commercial copper, though a cheaper product and fully satisfactory for plate material, was especially troublesome when being welded, owing to its oxygen content. For some time, the copper industry stood by and watched other metals and alloys being used in increasing tonnages for vats, tanks, stills and other types of containers, while copper was a wall-flower and wasn't being invited to join in the fun. Something had to be done about it, said Mr. W. C. Swift, whose name is synonymous with "copper welding" throughout the country. He aroused the industry to action, and in September, 1933, *The Welding Engineer* was privileged to herald the new "long arc" welding of copper with the carbon arc, which made it practicable to weld ordinary commercial copper as well as deoxidized copper, obtaining 100 per cent strength joints, at great speeds and with no distortion of the parent plate, even on 20-gauge sheets. To date there has been fabricated more than $150,000,000 worth of copper equipment which would not have been manufactured except for the "long arc" process of welding. The story of copper will some day soon have to be repeated for certain other metals and alloys, of which duralumin is one, if they are to hold a large share of the business in the metal field. ¶ Some have learned the lesson that the findings of metallurgical laboratories are not the only important facts about metals. The physical characteristics of the plate or tube may be ideal. But what is the reaction when the arc or torch is turned on it? What changes take place when it is deep-drawn? Will it show the same properties ten years from now that it does today? Can the surface be decorated or coated successfully? To answer all such questions means painstaking investigation, followed by development work to make improvements here and there where they are needed. If such efforts are fruitful, the reward is great. ¶ Important developments in high-strength steels have recently appeared on the horizon. In the main, these steels can be welded successfully. This fact is partly responsible for the increasing interest being shown in these new alloys. It is those concerns who have made a scientific study of welding and have applied the process successfully to their production problems, that are showing greatest enthusiasm in these new steels, chiefly because of their advantages in weight elimination. Electrodes are available on the market that will weld these new steels and give joints having proportional limits and ultimate strengths equal to or above the base material. These steels are pushing rapidly to the fore. ¶ Weldability has come to be a prime factor when selecting the proper metal for a machine part or structure. More and more the interest of the metallurgical engineer is being centered on obtaining weldability of the product. ¶ It is a fair question to ask, What is meant by weldability? Was copper a weldable metal before the development of the "long arc" welding process? While copper has been welded for many years, its weldability wasn't anything to brag about, and there are those who claim that only in the last two years could this metal be labeled "weldable," and they have many sound arguments to back up their point. If we accept this attitude, then here is a metal that passed from the stage of unweldability to that of weldability without any change in the analysis or structure of the metal itself or in the method of manufacture—it is the same metal both before and after the transition period. It was the development in welding procedure that made copper weldable, and not metallurgical research. ¶ Hence, while the metallurgist tries to develop a metal or alloy that will meet certain requirements as to physical properties, the welding laboratory itself may hold the key to the problem of weldability. This would indicate a need for close cooperation between the metallurgical and welding laboratories. Manufacturers of welding equipment and supplies have lended valuable assistance along this line. To their efforts is due a great deal of the fruitful results of the metallurgical laboratory, for without the development of procedures that create "weldability," today's heavy demand for metallic sheets and plates would have been a dream rather than a realization.

The Welder Craftsman Leaves His Mark

● Pick up a piece of welded furniture and examine the surface for the craftsman's mark. It is nowhere to be seen, except on the welds. Every weld that the grinder has not touched is just as truly the impression of the welding craftsman as if it were his finger print. If we were blessed with the scientific perspective that would enable us to "read" the weld, we might tell the name of the individual who made it, and we would be right more often than wrong. More than that, the weld reveals certain characteristics of the man who made it. It doesn't take the insight of a palmist to see that this weld was made by Jim, who is sloppy in his personal habits; that one was made by Harry, who is careful about little details; and the one over here was made by Bob, who has an artistic leaning and a good sense of perspective and proportion. If the public were as discriminating about welded products as they are about a plank of steak, and could interpret welds as readily as they read the newspapers, there would be more Harrys and Bobs in the welding business and fewer Jims.

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The Welding Engineer

VOLUME 20 JANUARY, 1935 NUMBER 1

Operation and Care of Arc Welders

By M. W. GOODMAN
Goodman Electric Machinery Co.

IN DISCUSSING the operation and maintenance of arc welders, consideration will be given to direct-current and alternating-current equipment.

Direct-current arc welders may be divided into two general classifications: constant-potential arc welders and variable-voltage arc welders. The constant-voltage machines were used in the early days of arc welding, and they are still used where a number of welders are drawing current from the same generator. However, the variable-voltage machine is in general use at present, where each operator welds from a separate welding generator.

The variable-voltage type of direct-current welding generator is of two general designs: first, the separately excited machine and, second, the self-excited machine. All variable-voltage welders must make some provision for a constant voltage across the exciting field. When a separate exciter is used, the main current from the exciter is delivered generally through a rheostat to the main welder fields. In the case of the self-excited welder, an auxiliary brush is generally provided. One side of the field of the welding machine is connected to this third brush and the other end of the field is connected in the conventional manner. This provides a field with an approximately constant voltage, which is necessary for excitation.

Exciter Brushes Should Receive Special Care

Where a separate exciter is used, special care should be given the brushes on the exciter. The exciter generally is quite small and usually has but two brushes. If either one of these brushes is raised from the commutator for an instant, there is the possibility of reversing the polarity and sometimes of losing the excitation. A roughened exciter commutator, or dirt or oil may contribute to the instantaneous removal of the brush from the commutator.

This same condition does not apply to the main commutator brushes because there are two or more brushes on the same brush and stud working independently but all in parallel. Frequently welders have four poles or more, and then two or more sets of positive and two or more sets of negative brushes are used. Any one of the brushes may jump from the commutator for an instant, but there are always three or more others of the same polarity working in parallel. It is unlikely that all the brushes would be raised from the commutator at the same instant.

Formerly oil-waste-packed bearings were used to a large extent on welders. These were especially objectionable where the welder was portable. Now, however, ball bearings are used universally. Every six months the grease in the bearings should be checked. If new grease is added, care must be taken not to pack the bearings too full of grease as this has a tendency to overheat the bearings.

Couplings Should Not Be Neglected

The general trend today on electric-motor-driven welders is to build the motor and the generator on the same shaft, although there are many direct-coupled welders in use. Couplings have a tendency to become loose and wear, due to the sudden application of power. This hammer-blow action will gradually wear the flexible part of the coupling. A good deal of welder maintenance can be saved if the coupling is kept in reasonably good condition.

The welding leads that are used with a welding machine should be as short as practicable. The welding cable should also be of sufficiently heavy size. Considerable power may be lost in the welding cables if they are too long, and this loss of power actually reduces the maximum power that can be delivered by a given machine at the electrode.

Long Leads Can Be Made of Shorter Lengths of Cable

Of course, long leads sometimes must be used. An efficient way of using leads is to have each length about 40 or 50 ft. long, with copper lugs sweated into each end of each piece. It then becomes an easy matter to lengthen or shorten the cable as required by the individual job.

Where a.c. transformer welders are used, the length of cable becomes especially important. Not only should every precaution be taken to keep the cable short in this case, but as far as possible the cables should be close together (preferably taped together) wherever conditions will permit. Furthermore, if possible, do not place the cables on steel. If the cables can be supported on wood, concrete or other non-magnetic material, better results will be obtained when using the transformer type of welder.

When Selecting Engine to Drive Welder, Pick a Heavy One

Frequently the owner of a small welding shop has need for a gasoline-driven direct-current welder and decides to assemble the welder himself by purchasing a separate welder and a separate engine. This can be done successfully by anyone who takes proper precautions. First, the welding generator should have a normal speed not greater than 1500 r.p.m. It should operate in the correct direction for gasoline-engine drive. The ordinary engine used in a passenger automobile is in general not satisfactory to drive a welder. An engine such as used in an automobile truck is of heavier construction and will stand up better. The radia-

tor should be large and a quick-acting governor is required. An idling attachment for the engine will save gas and engine wear.

Another question that comes up for the job-shop owner to decide is whether he shall install a gasoline-engine-driven welder or an electric-driven set. There is no question but what the electric-driven set is better from a machinery standpoint. The only advantage of the gasoline set is that it may be taken anywhere to do a welding job. However, it must be borne in mind that gasoline sets cost much more to operate and maintain than electric sets. If the gasoline set has a starter, this will help, particularly in cold weather. At best, the gasoline-engine-driven welder is a necessary evil and should be used only where electric power is not available.

Some Welders Can Be Adapted to Various Power Circuits

For those localities where there are several kinds of alternating-current power, the electric welder may be arranged with suitable control switches to operate the machine on either 2 or 3 phases, if necessary. Where direct-current plants are encountered, it is possible to have a spare direct-current motor, if the welder is of the direct-coupled type. The d.c. motor may be put in place of the a.c. motor to take care of jobs in direct-current plants. A still better arrangement, in case the welding-shop operator has many customers who use d.c. power in their plants, is to have an extra welder driven by a d.c. motor.

Another question, which has been the subject of much controversy, is, Which is better, a.c. or d.c. in the welding circuit? Recent developments of welding rods have brought about a better understanding of this subject, and now a.c. welding may be recommended or even preferred for many applications.

For very heavy-current welding on heavy sections where 400 amperes and upward is used, a.c. welding has an advantage in that there is no arc blow. The question of arc blow does not become important when currents not higher than 300 or 350 amperes are used, and in that case the ordinary d.c. arc welder is still generally preferred.

Transformer Welders Work Best With Heavy-Coated Electrodes

This much, however, may be said in favor of the ordinary transformer welder of the 200 or 300 ampere size. When heavily coated electrodes are used, the a.c. transformer welder works better than with ordinary electrodes. For comparatively low currents, such as used in sheet-metal work, the ordinary transformer welder is not suitable except when used with some special high-frequency device.

There are certain disadvantages inherent in any a.c. transformer welder. The power factor of a transformer welder is likely to be quite low, and this power factor is affected by such things as open-circuit voltage, length of leads, position of the leads relative to one another, and the presence of steel in the vicinity of the leads. Power companies, in general, object seriously to low-power-factor loads and sometimes penalize the customer in his power rates for using low-power-factor apparatus.

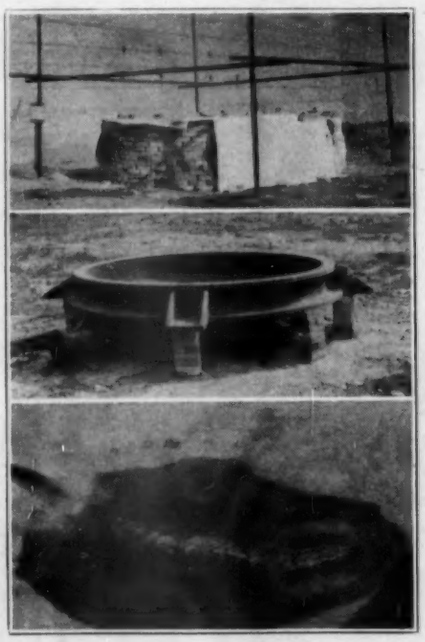
During the winter months welding machines are frequently used for thawing pipes that have been frozen. Where this is done, the stabilizer may be cut out of circuit to save power. The welding leads should also be kept as short as practicable.

Welded Repair on Huge Gray-Iron Casting

The repair welding of a cast-iron bottom of a still, recently performed by the Anchor Welding Service, of Chicago, is interesting chiefly because of the size of the job. This still, which is shown in one of the illustrations, weighed 13,000 lb. and is 14 ft. in diameter. Fracture occurred in the bottom, along a line running from the drain. This was chipped out and welded, the weld being 4½ in. thick and 40 in. long. A hundred and fifteen pounds of cast-iron welding rod was consumed.

The size of the casting made it necessary to build a temporary preheating furnace for it in a vacant lot adjoining the welding shop. A pipe framework was built around the furnace as a support for tarpaulin, should it be necessary to protect the furnace and casting from rain.

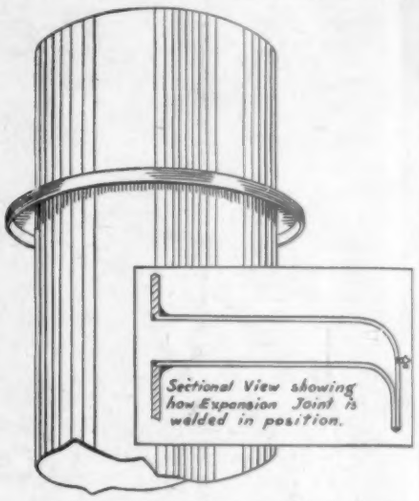
Heating required 11 hours, and 2500 lb. of charcoal was consumed. The actual welding time was 5½ hours, with two operators working. Three and a half days were required for cooling.



Lower View Shows Repaired Crack in 6½-Ton Still Bottom After Welding. Preheating Furnace and Casting Are Shown in Upper Views.

Pipe Expansion Joint Made by Welding

A sample expansion joint for piping consists of two flanges, or collars, which are welded to the ends of the pipe or tube as shown in the illustration. These flanges protrude from the outer edge of the pipe a distance of 4½ to 6 5/16 in., depending upon the diameter of the pipe itself, and both flanges are separated by an inch of air space, which amply allows for expansion and contraction under the most severe temperature changes.



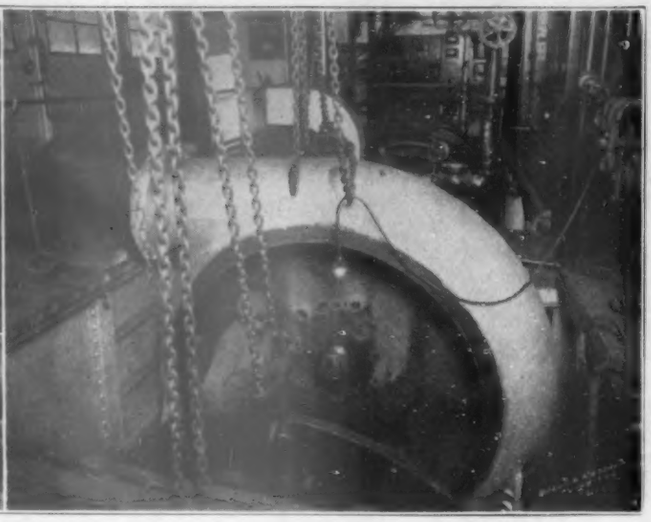
Details of Welded Expansion Joint.

This joint is a patented design by the Allis-Chalmers Mfg. Co., and was used in the pipe line, made of Plykrome, a stainless-clad steel, recently installed for the Milwaukee Sewerage Disposal Plant at Jones Island. The pipe in this case ranges from 2 to 5 ft. in diameter, and carries 100,000 cu. ft. of air per minute under a pressure of ten pounds per square inch. The flanges comprising the expansion joints were made of 10-gauge solid stainless steel. These joints were placed every 54 ft. along the 1800 ft. of pipeline.

First Texas Conference in Several Years

The first welding conference to be held in Texas in several years will be in session at the Texas Technological College, at Lubbock, during Feb. 14th and 15th. Technical papers dealing with the welding and cutting processes, and exhibits and demonstrations, will feature the program.

View of Dredge-Pump Impeller After Having Been Cut Away From Shaft.



The Housing Was Not Damaged by the Cutting Operations.

Cutting Torch Performs Emergency Operation

■ By GUS JOHNSON
Air Reduction Sales Co.

A COMPANY engaged in marine contract work was confronted with the problem of removing a 6-ton manganese-steel impeller from the main centrifugal pump on their No. 16 dredge. A large stone had wedged itself in one of the blades, damaging the impeller beyond repair, and necessitating its removal.

The company had been successful in attempting to back the impeller off the shaft with a 50-ton crane and several 10-ton jacks, using the heat from oxy-acetylene torches to expand the hub, but the large stone wedged in the impeller added greatly to the difficulty in removing the damaged part. It was very essential to preserve the pump housing and the impeller shaft, as well as to do the work with the least possible delay, since the centrifugal pump was urgently needed on a job at Toledo, Ohio.

Casing and Shaft Had to Be Protected

In removing the damaged impeller by oxyacetylene cutting, there was some danger of damaging either the pump casing or the threads on the end of the pump shaft, which would have caused an indefinite delay in securing the necessary replacements. We understood that if the shaft itself, which was 10 in. in diameter and 16 ft. in length, were damaged, the cost of replacement would be $1,900 in addition to the cost of the other parts involved.

After sizing up the situation, we realized that we were in a tough spot. Several job welding companies had been consulted, and they all had refused to undertake the work because of the complications involved. We realized that it would be practically impossible to remove the impeller without doing some damage to the pump casing or to the threads of the shaft. We succeeded in making the customer realize what we were up against, and he agreed to gamble on the results, instructing us to remove the impeller in the best possible manner.

Impeller Casting Cut Off of Hub

We decided to make a preliminary cut around the hub of the impeller, thereby removing most of the impeller casting. Due to the confined working space, a straight-head cutting torch and No. 4 tip were used. Much care had to be taken not to damage the pump casing, directly back of the impeller, the clearance between impeller and pump casing being about ¼ in. To eliminate any possible gouging of the pump housing liner directly in back of the piece to be cut, four streams of water were played on the back of the pump liner in order to keep the temperature of this plate below the ignition point. After four hours of constant cutting through 6 in. of manganese steel, the larger section of the impeller was removed.

The center, or hub section, remaining on the shaft was approximately 14 in. thick and 20 in. in diameter. At this stage, four radial cuts were made in the hub, two on the top, and two on the bottom. The two top cuts converged to a point about 1 in. over the estimated position of the shaft threads, the two lower cuts being similarly proportioned. The hub then looked like a piece of pie with two opposite 30° sections removed.

The No. 4 cutting tip was then removed and replaced with a No. 3 gouging tip, and gouging operations were begun at the bottom of the top vee. On each path of the torch, a light section was removed to a point approximately ¼ in. above the shaft threads. During the gouging operation, two streams of water were played on the shaft to keep it cool and to reduce the chance of burning the threads.

The hub was then revolved 180°, and the operation repeated on the opposite side, after which the hub was allowed to cool down to room temperature. Then the gouging operation was repeated, this time with more care. After each cut, the accumulated slag was removed with a chisel and a minute inspection made. This procedure was continued until all threads were exposed. The hub was then revolved, and the same operation and inspection repeated until the threads at the bottom of the vees were exposed.

Metal Removed Without Damaging Shaft Threads

Wedges were then placed in the upper vee and a 14-lb. sledge hammer was used to break the metal remaining in the threads. The hub was easily split in two, and removed from the shaft. An inspection of the shaft and pump housing was then made and we found that no damage whatsoever had been suffered during the cutting operations.

Twelve cylinders of oxygen and two

cylinders of acetylene were used in removing the impeller. The company obtained one straight-head cutting torch and one No. 3 gouging tip for use on the job. Two of us, including the writer, worked from 11:00 in the morning until midnight in removing the impeller. Figuring that two of the company's men had been employed eleven hours each at 75 cents per hour, the total cost of the job would have been $67.02, including $34 32 for oxygen, $16.20 for acetylene and $16.50 for labor. This represents a small charge for the removal of the impeller compared with the possible cost of a new pump housing or shaft if damaged in attempting to force the impeller off the pump shaft.

Program of Iowa Welding Conference

The three-day welding conference to be held at Iowa State College, Ames, Iowa, on Jan. 23rd to 25th, will consist of the reading of papers on welding, flame cutting, and metal spraying, and will include exhibits and demonstrations by manufacturers and distributors of equipment and supplies. This is the seventh annual welding conference to be held at this school. The program, which is in charge of Prof. D. C. Faber, is as follows:

Wednesday, January 23rd

8 a.m. Registration, Room 105, Engineering Hall.
9 a.m. Demonstrations, Aeronautical Laboratory.
1 p.m. Technical Session, Room 207, Engineering Hall. W. L. Allan, President, Iowa Blacksmiths Association, presiding.
"Facing Facts in Welding Costs," by L. C. Monroe, *The Welding Engineer.*
"What the Welder Thinks of Various Welding Jobs," by Henry Malek, Iowa Electric Welding Co.
"The Importance of Correct Welding Precedure," by F. C. Hutchinson, The Linde Air Products Co.
"Reclaiming Farm Implements," by L. O. Wiesse, New Process Plow Welding Co.
4 p.m. Demonstrations, Aeronautical Laboratory.

Thursday, January 24th

9 a.m. Technical Session, Room 207, Engineering Hall.
Motion picture, "The Prosperity Process," by courtesy of International Acetylene Association.
"Some Developments in Welding," by F. L. Spangler, *The Welding Engineer.*
"Safety in Welding and Handling Oxyacetylene Equipment," by E. M. Evleth, The Bastian-Blessing Co.
"Alternating-Current Welding," by W. M. B. Brady, General Electric Co.
"Recent Developments in Silver Solders," by W. J. Carle, Air Reduction Sales Co.
1 p.m. Demonstrations and Qualification Tests, Aeronautical Laboratory.
6:30 p.m. Welders' Banquet, direction of W. L. Allan.

Friday, January 25th

9 a.m. Technical Session, Room 207, Engineering Hall.
Motion pictures, "Barrel Welding" and "Multi-Flame Welding," by courtesy of The Linde Air Products Co.
"Application of Metal Spraying," by A. S. Miller, Major Engineering Works.
"Hard-Facing Farm and Road Machinery," by E. F. Smith, Haynes Stellite Co.
"Successful Welding of Manganese Steel," by E. L. Quinn, American Manganese Steel Co.
"High-Voltage Welding of Copper," by Clinton Swift, The American Brass Co.
"The Effect of Welding Procedure on Costs," by J. V. Flock, The Lincoln Electric Co.
1 p.m. Demonstrations, Aeronautical Laboratory.

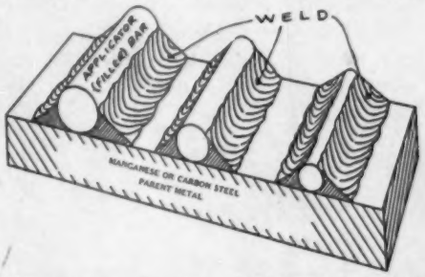
Milwaukee School Holds Welding Exhibit

A welding exhibit was a feature of the 32nd annual "open house" observed by the Milwaukee School of Engineering in its building at 1020 N. Broadway, Milwaukee, Wis., on Jan. 11th and 12th. Twenty-four companies, including users and manufacturers of welding and allied equipment, cooperated in putting on exhibits and demonstrations, including the welding of ferrous and non-ferrous metals and alloys, and metal spraying. On both days, lectures were given by D. D. Trimble, of the J. D. Adams Co., on good welding practice and procedure, by W. B. Keelor, of the Ingersoll Steel & Disc Co., on welding stainless-clad steel, and by Karl D. Falk, of the Metal Spray Co., on metal spraying. About 2000 people viewed the exhibits on welding, air conditioning, refrigeration, radio, television, electricity, aviation, and Diesel engines.

"Applicators" Reduce Costs of Manganese Welding

By B. H. PAYNE
Manager, Stulz-Sickles Co.

The major portion of welding of manganese-steel parts consists of replacing metal that has been worn away by impact and abrasion. This is particularly true of the rebuilding of worn 11% to 14% manganese-steel castings such as special track-work, gyratory jaws, roll and cone



Illustrating the Correct Use of Nickel-Manganese Applicator Bars.

crushers, buckets, lips, etc., by the use of nickel-manganese steel electrodes. The more speedily this surface can be built to size, the greater is the economy.

Speedy building-up can be accomplished by using "applicator bars," which are available in rounds, 5/16 to 1½ in. in diameter, and which can also be applied to ordinary carbon-steel parts, and provide an armored manganese-steel surface that will resist impact and abrasion equally well if not better than new 11% to 14% manganese-steel castings. "Applicator bars" also considerably widen the field of rebuilding, since they make it possible to reclaim castings that have worn down to a point where the cost of rebuilding by the ordinary drop-by-drop application method would equal if not exceed the cost of a new part.

"Applicators" are a rolled nickel-manganese steel product and consequently possess an improved grain structure, greater density, and more uniform resistance to impact and abrasion compared with 11% to 14% manganese steel.

One of the outstanding advantages of nickel-manganese steel "applicator bars"

Crusher Plates Can Be Quickly and Cheaply Reclaimed.

is that heat does not harm them, as is the case with ordinary 11% to 14% manganese steel. Further, their use permits of the work being done with much less heat getting into and damaging the parent metal, as a great part of the welding heat is dissipated into the "applicator bars" and thence into the air.

The industrial field affords the greatest opportunities for the use of "applicator bars." These are applied usually to those jobs that might be described as being unusual, though the railroads are making some use of them for the building up of worn manganese frogs and crossings.

Nickel-manganese steel is now also produced in the form of forged wedges, in standard sizes, which are applied by

Gyratory Bell and Liner Rebuilt With "Applicator Bars".

attaching to worn shovel and dipper teeth and welding into place with nickel-manganese steel electrodes, thus making an economical repair. These nickel-manganese wedges are of considerably finer grain than is found in 11% to 14% manganese-steel castings, and consequently afford a higher resistance to impact and abrasion than is provided by a new casting.

Reconditioning Rail Ends . . .

Paper read at the 35th annual convention, International Acetylene Association, held in Pittsburgh, Pa., Nov. 15 to 17, 1934.

■ By C. H. R. HOWE
Cost Engineer
Chesapeake & Ohio Railway

THE extent to which welding is used as a means for reconditioning damaged rail is illustrated by the replies received from fourteen representative railways, to a questionnaire of the American Railway Engineering Association. These railways advised that they were repairing annually 504,000 battered rail joints by the oxyacetylene process and 407,000 by the electric-arc-welding method. The general result to be accomplished in both cases is the restoration of the rail head to an even surface, and the preservation of that condition for as long a period as possible.

To provide durability, it is essential that the finished weld, or rail end, for a distance of at least 2 in., be considerably harder than the rest of the rail surface.

Alloy-Steel Welding Rods Avoid Brittleness

Rail steel, containing approximately 0.70% carbon and having a Brinell hardness of about 255, is high-carbon steel; and it is a fact well known to metallurgists that welding rods of a high-carbon content—that is, much in excess of 0.70%—cannot be used to increase hardness, for to do so strength is sacrificed, as the weld will be too brittle. In order to secure the desired hardness of the rail end (325-375 Brinell) and at the same time avoid brittleness, recourse is made to various alloy-steel welding rods. As steel containing manganese, say from 9% to 16% as an example, to produce the necessary hardness, cannot be used with oxyacetylene due to oxidation in the flame, the use of such rods is limited to the electric-arc method, where the metal of the rods can be protected by a coating which prevents oxidation. The method used to secure hardness with the oxyacetylene torch will be described later.

The electric-arc-welding process is based on the natural phenomenon that when an arc is formed across a gap in an electric circuit, the heat generated vaporizes a small portion of the end of the welding rod, which is used as an electrode at one end of the open circuit. This incandescent vapor acts as a conductor for the current as it passes from one side of the gap to the other and carries the additional material to the fused work, or parent metal, through the arc stream itself.

When steel is welded by the electric-arc method, a portion of the metal adjacent to the weld (for approximately ½ in. each way) is heated to a "critical temperature". Then, as the work is large as compared with the weld, the heat is conducted rapidly away, allowing the weld to cool quickly. The result is that the structure of the parent metal immediately adjacent to the weld is changed, the carbon remaining in more perfect chemical affinity with the iron, and a hard, brittle section adjoining the weld is the result. Unless the cooling is sufficiently slow to permit self-annealing of the parent metal, a distinct line of cleavage is established which may result in fracture. To a more or less extent, this line of cleavage exists in all welds of harder alloy rods to high-carbon steel.

Excessive Heat May Cause Decarburization

Damage to rail through decarburization, as the result of excessive heat application, may take place with either the electric-arc or oxyacetylene processes, but is less likely to happen with the arc, as it can be more easily controlled. The type of electrode used is an important factor, for electrodes which have been dipped and have a light coating tend to stabilize the arc, prevent the metal in the arc from oxidizing, and form a thin slag covering, which protects the deposited metal from oxidizing and too rapid cooling. In commercial welding, where rapid production work is desired, heavily coated, or "speed rods", are very popular. These are used in the so-called shielded-arc process; they have a very heavy covering, which melts less rapidly than the electrode, so that the arc extends up inside the covering. A longer arc can be used without danger of oxidation of the metal in the rod. Higher arc voltage can be used, with resulting increase in heat, speed, and amount of metal deposited.

Preheating is desirable, but not always necessary, when arc welding—though it is thought to be a wise precaution, especially during very cold weather, against checking and cracking of the weld. Where small rods are used, the amount of heat is not so great and there is less tendency to check; such work is not preheated.

The principles of practice employed in the oxyacetylene process are radically different from those of electric-arc welding. Fusion of rod and parent metal is accomplished by igniting a high-pressure mixture of acetylene gas and oxygen and directing the flame from the torch against the welding rod and parent metal, until both become unified. Such preheating as may be necessary in advance of the pool, is readily accomplished by use of the same torch flame.

Rods too high in carbon cannot be used to advantage in gas welding, for, as with the electric arc, hardness of the weld would be accompanied by excessive brittleness. Bare alloy rods of medium carbon content are generally used. The resulting hardness of the welds from such rods and rail steel is from 280 to 290 Brinell. Since this is considerably below the desired 325 to 375 Brinell, recourse is made to heat-treating and quenching, the principles of which have been known and practiced in many industries ever since steel was first produced. The process is simply a controlled change in the metallographic structure. This can be accomplished either with the heat of an oxyacetylene flame, or an electric carbon arc, and may also be applied to new steel rails. The advantages and details of this practice will be more fully discussed later in this address.

Weld May Be Deposited Rough or May Be Shaped While Hot

There are two distinct methods of finishing rail-end welds. The weld may be deposited roughly, and then have the surplus material removed by grinding to the proper face, or the weld may be shaped while still under heat, with hammer and flatter. The latter method is somewhat slower than grinding, but it is thought to have the advantage of producing a better weld, in that the working of the metal with the hammer tends to relieve locked-up stresses, which are due to the stretching of the ductile metal as the weld cools and contracts. When welds cool without hammer-working, there is always the possibility of fracture due to unequal distribution of internal stresses. It is a well-known fact that manganese frogs, for example, cannot be welded successfully without peen-hammering.

The oxyacetylene method possesses this

distinct advantage over the arc method: There are many rail joints that become battered out of shape, due to side rolling and end flow, yet there remains enough metal to permit up-setting to the true surface without adding any material. This permits out-of-face working of joints, with resulting uniform riding quality of track.

Attention is also called to the fact that joints which have been rebuilt by the electric-arc process cannot later be swedged to shape by heating to a forging temperature with the oxyacetylene flame, until all the manganese electrode previously deposited by the electric arc has been burned away. On the other hand, an arc weld can be superimposed on a previously deposited oxyacetylene weld.

Heat-Treated and Beveled Rails Show Less Batter

In May, 1932, a comparative test of the merits of heat-treating and beveling was inaugurated on a section of heavy-traffic track (see charts below). A total of 142 joints, in sequence, were included, as follows:

Heat treated and beveled	39
Heat treated, but not beveled	40
Not heat treated, but beveled	37
Not heat treated and not beveled	26
Total	142

At the expiration of 16 months the average batter of these joints was:

Heat treated and beveled	0.0034 in.
Heat treated, but not beveled	0.0051 in.
Not heat treated, but beveled	0.0152 in.
Not heat treated and not beveled	0.0152 in.

On the assumption that 1/16 in. (0.0625 in.) is the permissible limit of batter, the progress of the damage from batter is respectively 5% to 20%, as shown above.

The tonnage that passed over this track during the first sixteen months was 31,335,000, or an average of 1,958,-438 gross tons per month.

The last previous installation of rail at this point, 130-lb. P. S. section rail, consisted of 780 ft. laid in April, 1929, and 5226 ft. laid in March, 1927.

The weighted average of laying time, August, 1927, carried before removal, was 147,926,040 gross tons—an average of 2,595,193 gross tons per month. This rail was rebuilt twice, and at some joints three times, during its life of 57 months. Equating this life to compensate for present lighter traffic, the rail would have been in track 75.5 months, or 6 years 3½ months.

At the end of 28 months of this test, the progress of batter had been such that it was necessary to repair certain of the joints by welding as follows:

	No. Repaired
Heat treated and slotted	None
Heat treated but not slotted	2 (5%)
Slotted but not heat treated	26 (70.3%)
Not slotted and not heat treated	25 (96.1%)

It is not logical to expect that the ratio of 5% and 20%, or 4-to-1, for the first sixteen months, as the respective rates of batter of the treated and untreated ends, would mean an increase in the life of the heat-treated rail of four times, for the factors of underhead wear, surface and line bends, bolt tightness and surfacing, etc., have a distinct bearing on rail life. However, with proper attention to maintenance, and the possible application of new, or reformed joints, bars and bolts, it should not be impossible to double the life of rail.

All Untreated-Unbeveled Rail Ends Were Chipped

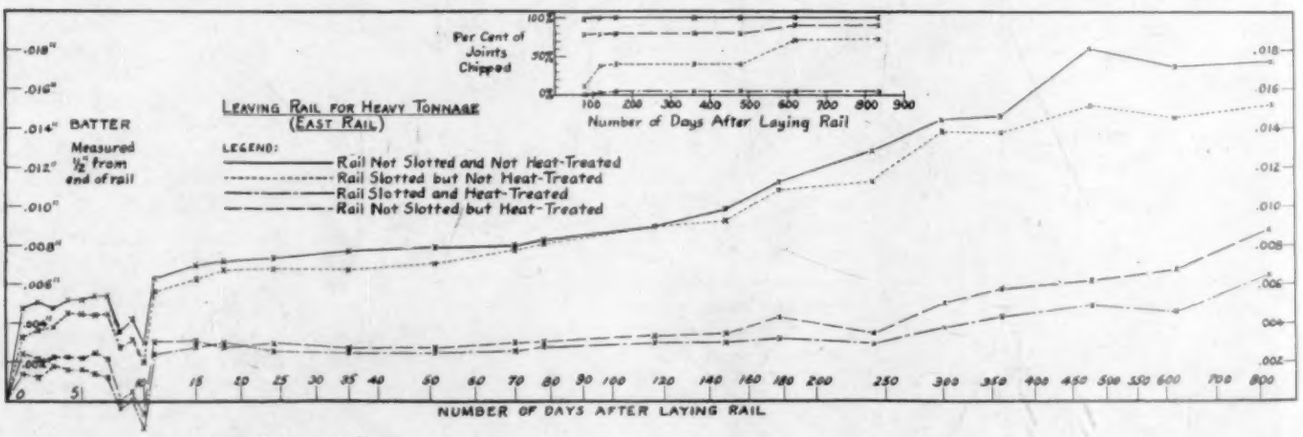
It is of interest to note that on the date of the sixteen months' recording, 100% of the untreated-unbeveled rail ends were chipped, while but 5% of the heat-treated and beveled (chamfered) ends were so damaged. The importance of beveling is noted in the fact that 90% of the heat-treated but unbeveled rail was end-chipped.

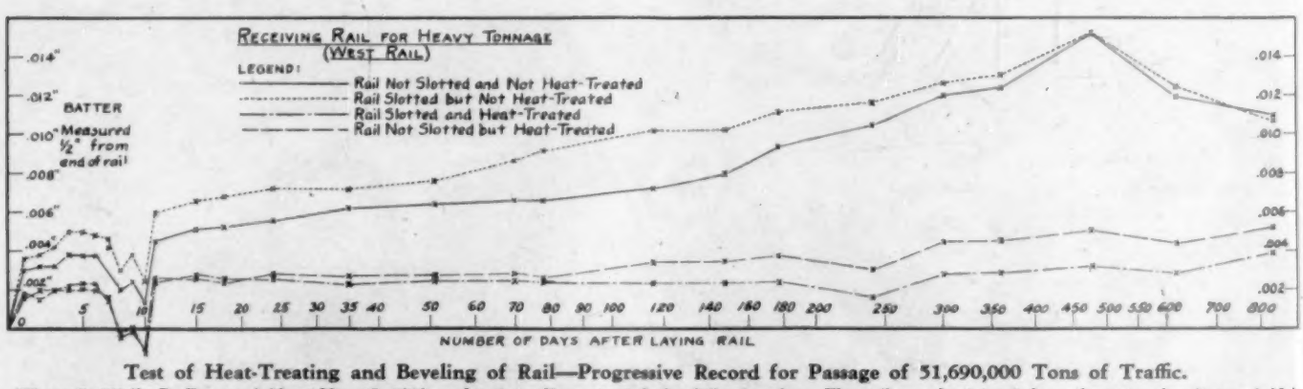
As of July 1, 1934, there were on this railway 601 miles of new rail track that had ends of rail heat-treated and beveled, in addition to 1239 miles of rebuilt ends that had been heat-treated.

The effect of this work should materially increase the life of rail and decrease the amount of future welding necessary.

Such costs of arc welding performed by company forces on the railway in question, as are available, are not typical of general conditions, since all such work was done in connection with frog and crossing repairs in dense-traffic territory.

We are informed that arc-welding


Per Cent of Joints Chipped
Number of Days After Laying Rail
LEAVING RAIL FOR HEAVY TONNAGE (EAST RAIL)
BATTER
Measured ½" from end of rail
LEGEND:
Rail Not Slotted and Not Heat-Treated
Rail Slotted but Not Heat-Treated
Rail Slotted and Heat-Treated
Rail Not Slotted but Heat-Treated
NUMBER OF DAYS AFTER LAYING RAIL


RECEIVING RAIL FOR HEAVY TONNAGE (WEST RAIL)
BATTER
Measured ½" from end of rail
LEGEND:
Rail Not Slotted and Not Heat-Treated
Rail Slotted but Not Heat-Treated
Rail Slotted and Heat-Treated
Rail Not Slotted but Heat-Treated
NUMBER OF DAYS AFTER LAYING RAIL

Test of Heat-Treating and Beveling of Rail—Progressive Record for Passage of 51,690,000 Tons of Traffic.
(The rail, 130-lb. R. E., was laid on May 17, 1932, and test readings started the following day. The rail was heat-treated on the same day it was laid.)

costs on some railways have run from $0.15 to $0.155 per in. of weld. During the past seven years the length of welds of the railway quoted have steadily decreased, due largely to catching up with the damage rate, until during the year 1933 the average length became approximately 6 in. At an average rate of $0.15, the cost for electric-arc welding per joint would have been $0.15 × 6 = $0.90, plus a slight cost per joint for services of flagmen.

This figure compares very closely with the results obtained by the forces using oxyacetylene during the year 1933, as will be seen in the following table:

SYSTEM STATEMENT OF COSTS—BUILDING UP RAIL ENDS
Oxyacetylene Process

	TOTAL COSTS				AVERAGE COSTS		
Year	Quantity	Labor	Material	Total	Labor	Material	Total
1927	41,355	$32,429.26	$22,221.92	$ 54,651.18	$.7842	$.5373	$1.3215
1928	91,283	50,116.07	35,053.77	85,169.84	.5490	.3840	.9330
1929	129,881	65,670.84	52,106.81	117,777.55	.5056	.4012	.9068
1930	151,430	82,354.25	59,796.05	142,150.30	.5438	.3949	.9387
1931	147,639	79,630.36	55,230.56	134,860.92	.5394	.3741	.9135
1932	130,251	64,527.19	43,122.78	107,649.97	.4954	.3311	.8265
1933	156,238	86.885.34	50,518.66	137,404.00	.5561	.3233	.8794*

*Includes heat-treating rail ends.

In addition to the work performed on rail joints, the following statement shows the quantity of frogs, crossings and switch points repaired in the field during the past two years, from which figures it will be noted that the practice is to use the method best adapted to the work in hand:

		TOTAL COSTS			AVERAGE COSTS		
Year	Quantity	Labor	Material	Total	Labor	Material	Total
TURNOUT FROGS							
1932—Oxyacetylene	125	$ 954.18	$ 631.40	$1,585.58	$ 7.6334	$5.0512	$12.6846
1933—Oxyacetylene	192	2,014.05	978.74	2,992.79	10.4898	5.0976	15.5874
1932—Elec. Welding	223	3,275.35	656.77	3,932.12	14.6877	2.9452	17.6329
1933—Elec. Welding	424	7,747.85	2,240.08	9,987.93	18.2732	5.2832	23.5564
CROSSING FROGS							
1932—Oxyacetylene	3	$ 87.02	$ 24.68	$ 111.70	$29.0066	$8.2267	$37.2333
1933—Oxyacetylene	44	332.81	184.77	517.58	7.5639	4.1993	11.7632
1932—Elec. Welding	157	4,134.61	974.34	5,108.95	26.3351	6.2060	32.5411
1933—Elec. Welding	88	2,019.83	689.30	2,709.13	22.9526	7.8329	30.7855
SWITCH POINTS							
1932	715	$2,332.26	$1,045.10	$3,377.36	$ 3.2619	$1.4617	$ 4.7236
1933	1,387	4,311.02	1,778.69	6,089.71	3.1082	1.2824	4.3906

Also during the year 1933 the following welding was done at the railway company's shops:

	Average Cost
32 Rigid Frogs (O. H.)	$32.91
112 Spring Frogs (O. H.)	30.81
719 Switch Points (O. H.)	7.18
180 Manganese Frogs	33.80

These costs include scrap value, labor, material, supplies and overhead.

Besides the electric-arc-welding repairs to track structures, this railway has an arc-welding outfit which is used extensively in repairing steel bridges. The largest bridge job done thus far involved 1200 ft. of ⅜-in. welds, applied at a total cost of a little less than $1.00 per linear foot.

Rail-Welding Processes Have Greatly Improved

Comparisons purporting to show the respective merits and economies to be obtained through the use of either arc or gas welding are apt to be misleading unless full knowledge of facts show the conditions to be similar. An impartial investigation will disclose that both the electric-arc and oxyacetylene processes for welding rail have been greatly improved during the past few years—the former through improvement in electrodes, the latter through addition of heat-treating, quenching and drawing. No comparison is competent unless the figures include all the factors representing the highest development of either art.

Unfortunately, no example now exists from which a direct comparison of up-to-date practice can be made on any large scale. The only railways which in the past have made extensive use of the oxyacetylene-heat-treatment process—namely, the Chicago, Milwaukee & St. Paul, the Erie, and the Chesapeake & Ohio—have used little, if any, modern-electrode arc welding. Furthermore, the extensive users of the electric-arc method—namely, Southern Pacific, Canadian Pacific, Pennsylvania, and others—have had little experience with the oxyacetylene-heat-treatment method.

Expense Includes Investment and Cost of Training

The development of the art of rebuilding rail ends is of comparatively recent origin, and it is quite natural that, as the value of the process became apparent, the railways should become interested. With the possibility of saving in rail bills assumed, the next question naturally is one of ways and means of accomplishment. Primarily, there is the cost of the investment; secondly, there is the excess cost of doing the work while training the welders.

During recent years the question of obtaining money to invest in equipment, regardless of possible savings that might be effected, has been serious with the railways, and it is only natural for them to turn to outside contractors who already have the equipment and skilled men to do the work. In addition to this, it is extremely doubtful whether a railway having very light traffic, and consequently long periods between reweldings, would be justified in investing money in equipment. Where reweldings are infrequent, the equipment lies idle with no return on the investment.

As to excess cost during the period while the employees are being trained for the work, reference to the table, already given, of annual costs with the oxyacetylene process, shows that for the first year of record, 1927, the cost per joint, $1.32, was 39 cents higher than in 1928, and that it required five years to reduce the cost to $0.83. This is also an added incentive to contract work. At the time this railway started welding in 1923, and in fact for several years later, there was no option in the matter, since there were no experienced outside rail-end welders; so the railway was left to its own resources. It is not unreasonable to expect that any railway starting to do its own work will experience the same difficulties.

Heat-Treated Rail Ends Offer Substantial Savings

Heat-treatment of both new and rewelded rail ends has a definite value that can be expressed both in rail life and in monetary terms. This conclusion has been arrived at by careful consideration and observation of rail so treated, both during the test periods and the time that has since elapsed. The process is by no means novel, as metals subject to great stresses or other severe usage, such as shocks, jars and undue abrasion, have been so treated for many years. In the rail joint, this necessity for so strengthening parts is recognized in that the American Railway Engineering Association has specified heat-treated track bolts.

The process of heat-treatment of rail ends consists of hardening the upper surface of the head for a short distance (2 in. back from each end). The surface of the rail head thus treated is about 100 points Brinell harder than the rails coming from the rolls, the hardening of the metal extending from ¼ to ⅜ in. in depth in order gradually to make a 100 point drop in Brinell to the rail proper.

Metallurgists know that iron and carbon are in perfect chemical affinity only at high temperatures, the degree of affinity depending entirely on percentages of carbon content and other chemical elements that may be present. The average carbon content of 130-lb. rail steel is approximately 0.70%; and when the rail end is heated to about 1292° F., complete solution of the carbon in the iron takes place. If the temperature could be instantly reduced to that of the atmosphere, the steel would consist principally of a perfectly solid solution of carbon in iron, known as austenite—an extremely brittle formation not suitable for the surface

carrying the wheel treads. However, it is not possible to cause this instantaneous cooling, but it is approximated by quenching with water till the metal temperature drops below the boiling point of water, 212° F.

During the transition from a temperature of about 1292° to 212°, three changes take place in the character of the steel: First, the iron and carbon begin to lose complete chemical affinity; second, in so doing heat is generated, which causes recalescence, or afterglow; and third, at the same time, the steel assumes magnetic properties, which it did not have at high temperature. After the temperature has been reduced, the steel produced is not entirely austenite, but is a combination of austenite with other less-brittle structures. The steel, however, is still too brittle for the service for which it is to be used, so it becomes necessary to anneal, or draw some of the temper, to make the surface more ductile, or less brittle.

In demonstrating the value of the above process, it is first necessary by field test to ascertain whether or not the process as applied in other industries is practicable for railway use. The Chicago, Milwaukee, St. Paul & Pacific Railway was the first to incorporate this work on a large scale, and now has several hundred miles of rail so treated. The Chesapeake & Ohio Railway did not establish this as standard practice until they had made very careful field tests to prove that results were as valuable as claimed by the Milwaukee. The monetary value to the railways, if this practice were general, would be important, even if the elongation of the life of the rail was far more modest than the results thus far would indicate them to be.

Yearly Rail Bill Might Be Cut $64,000,000

There are about 280,000 miles of first main line in the United States. If we assume the average life of rail to be 14 years, it means that 20,000 miles of rail is renewed each year in normal business times. If we assume that the average weight of rail is 100 lb. per yard and that the cost of replacing the rail per mile is 12,800 minus a salvage value of 25%, then we have 20,000 × $9,600 = $192,000,000 as the annual rail bill in the United States. If by heat-treating the ends of new and rewelded rails, we can secure as little as a 50% increased life of rail, we shall have decreased the rail bill by 33 1/3%, or $64,000,000 a year.

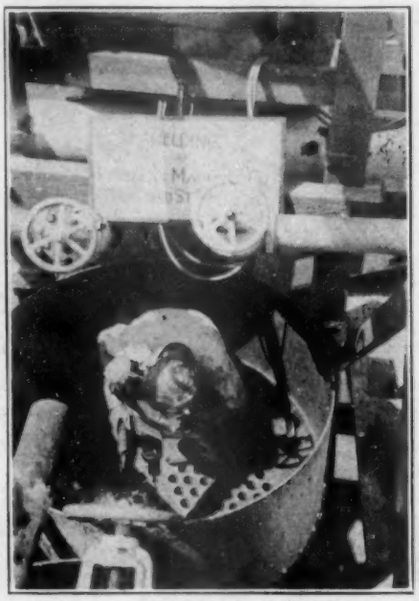
The treatment of rewelded rail is precisely the same as that for new rail, except that a higher initial temperature is used.

It has been found in actual practice that rail which is slightly chamfered at the ends does not have the same rate of damage as unbeveled rail.

In the rewelding of rail ends, the process of heat-treatment undoubtedly increases the intervals between rewelds. Naturally, this reduces the annual cost for rewelding, inasmuch as the cost of heat-treating and beveling, which is approximately $0.36 per joint, is only about one-third of the average cost of rebuilding the rail at the joints.

Shop Displays Its Sign on Outside Jobs

When doing work outside its own plant, the Pinellas Machine Co., of St. Petersburg, Fla., advertises the fact by hanging a display sign near the operator.



Welder Working on Ammonia Condenser, With Shop Sign Prominently Displayed.

The illustration shows a welder from the company are welding tubes into one of the heads of an ammonia condenser used in the manufacture of ice. These tubes are 2 in. in outside diameter, and there were 180 tubes to each head. The sign hung above the operator advertises the company to good advantage.

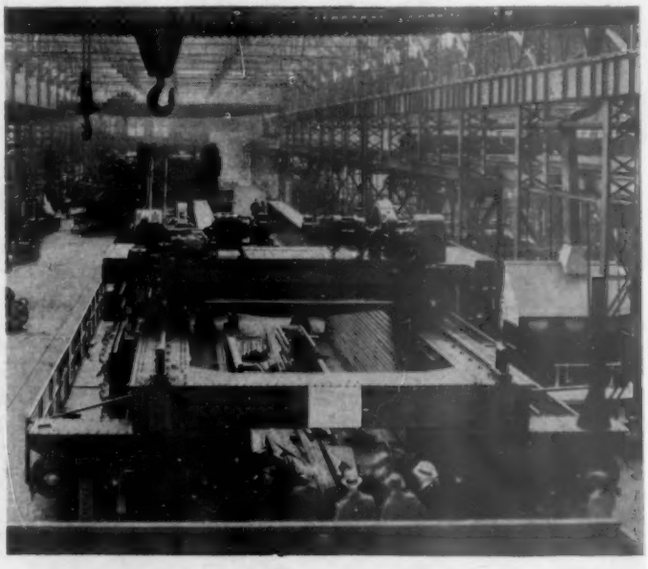
Strengthens Bridge Girders by Welding

In a recent strengthening job involving welding on the Nickel Plate Railroad bridge at Mackinaw Dells, near Eureka, Ill., plates were welded to the top and bottom of box-type wrought-iron girders, and cover plates were welded to the top of the two parallel inside girders. The bottom straps and tie rods also were welded, and turnbuckles inserted to take up slack. The contract for welding was let to Hallem Welding Service, of Long Island City, N. Y.

Cranes for Boulder Dam Have Welded Parts

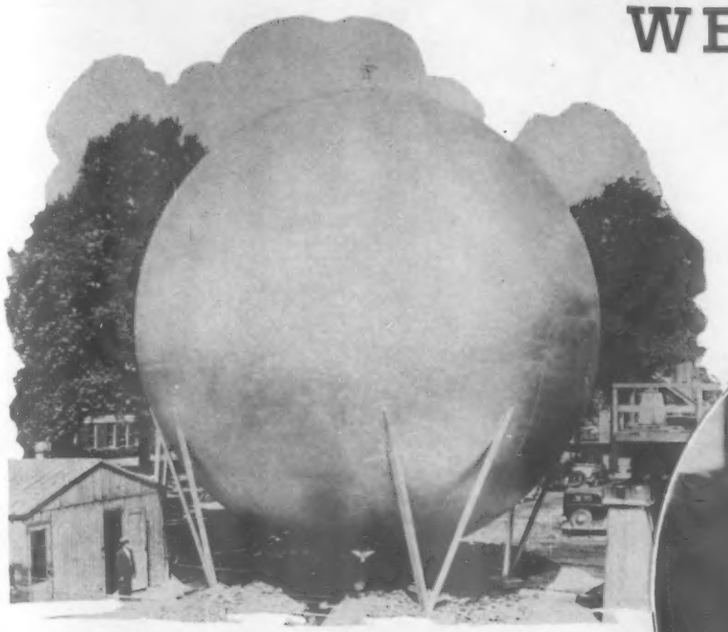
In contrast to conventional design, welding was used in the construction of the truck bodies and trolley frames of the four huge 300-ton electric cranes recently built by the Harnischfeger Corp., Milwaukee, Wis., for installation at Boulder Dam. In the construction of the trolleys, 350 ft. of 5/16-in. bead was laid on each side, making a total of 700 ft. for each trolley. It is estimated that castings for the trolley sides would have weighed approximately 35% more than these welded units. Welding not only resulted in economy in weight but in lower fabricating costs as well. Welding was also used in the construction of the cabs, on the steel floor plates, and in other places.

These cranes have a 64-ft. span and a lift of 70 ft., and were the chief point of interest in the Harnischfeger Corp.'s 50th anniversary celebration, held at the company's plant on Nov. 17th, which was attended by more than 1000 industrial executives, engineers, technicians and others.



Welding Was Used in the Construction of the Truck Bodies and Trolleys of These 300-Ton Cranes.

WELDING NEWS IN PICTURES



Tests showed no leaks whatever in this arc-welded 36-ft. sphere, erected by the Chicago Bridge & Iron Works at the General Electric Co.'s plant on East 152nd St., Cleveland, Ohio.

Building up eccentric, 25 in. in diameter, by spraying with high-carbon steel to ⅛-in. thickness. Work done by The Metal Spraying Corp., Milwaukee, Wis.

This bank lobby looks like a welding shop. Theodore Flecker, of Michigan Gases, Inc., is demonstrating gas welding and brazing at the invitation of the Peoples National Bank, of Grand Rapids, Mich., which institution is sponsoring industrial displays in its lobby.

A slope of 42 degrees on a hillside carries a part of the 1630-ft. Owyhee siphon, being constructed by arc welding on the Owyhee River in eastern Oregon. (Photograph courtesy of The Lincoln Electric Co.)

Constructing an All-Welded Ocean Pier

Fig. 1. Arc-Welded Construction Gives This Pier the Strength to Withstand the Battering of Heavy Seas. Not a Bolt or Rivet Was Used.

ARC-WELDING operators, hanging in "bosuns' chairs," most of the time uncomfortably close to 20-ft. seas, made over five miles of welded joints in erecting the steel framework of a new 2327-ft. ocean pier recently completed on the rugged, unprotected California sea coast at Davenport. A view of the welding operations is shown on the front cover of this issue.

This half-mile-long pier (see Fig. 1), which required over a year to build, was constructed for the Santa Cruz Portland Cement Co. as part of its plan to transport bulk cement from its plant at Davenport, Calif., where there is no harbor, to various points along the west coast. The pier carries two 12-in. pipelines for cement, one 6-inch oil line and one 3-in. water line.

In order to provide a structure that would withstand the constant battering of the waves, not a bolt nor a rivet was used. All connections were made by arc welding.

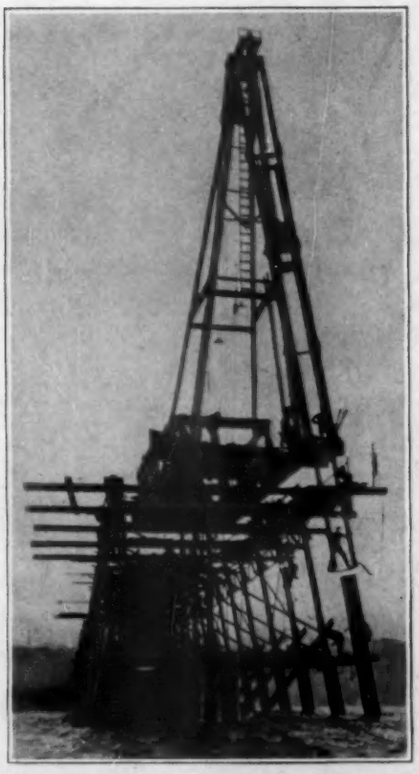


Fig. 2. End-On View of Bent No. 131 Head Being Lowered to Drive Tubular Pile.

To meet engineering as well as shipping requirements in building the pier, it was necessary to make a survey of the ocean bottom for the entire length of the proposed structure. This survey, made in September, 1933, required taking soundings, shale elevations and sand depth. The bottom was found to be shale the full length of the project, with sand depths varying between 6 in. and 6 ft. A careful check was made to be sure the extending pier would be headed directly into the seas.

Piles Are Made of H-Columns

From the results of the survey, it was decided to use H-column piles and to drive them to refusal with as much penetration as possible. The adhesive and bond value of the shale was determined by test.

A combination steel cylinder and H-beam pile trestle, well braced and carrying a timber deck, was designed. The procedure adopted for construction consisted of completing each bent and span of the pier before starting the next. All connections were arc welded, there being over five miles (26,790 linear feet) of welding in the entire structure. More than 22,000 lb. of electrode was used.

The first 840 ft. of pier consists of 56 bents on 15 ft. centers, each bent having three 33-lb. H-column piles. The two outside piles are battered 12-on-1. Each bent is X-braced, with every other bent sway-braced by 4x4x3/8-in. angles. The three piles are tied together with a sash brace. A longitudinal brace of 4x4x3/8-in. angles carries through on each outside pile of the bent. The piles are tied together longitudinally by a truss 4 ft. deep. All braces are electrically welded and the bents are capped with 12x12-in. by 16-ft. timbers.

Completion of the 840 ft. from the abutment brought the pier to the breaker line, where the water has a depth of 14 ft. at mean lower low tide. Since the breaker line is the point of greatest wave force, heavier construction was used through the breaker line and for the remaining 80 bents of pier, which were spaced on 18-ft. centers.

Temporary Guide Frames Provide Working Platform

The procedure followed in constructing the 136 bents of pier required a temporary guide frame to hold the cylinder piles in place and, at the same time, provide a working platform while driving the piles (see Fig. 2). This frame was held at an elevation of 1 ft. below the cylinder cut-offs by cables from the last-completed bent. The frame was left in place until the entire bent was finished,

after which it was picked up and moved ahead for the next bent. With the frame in position, the three cylinder piles were driven and cut off to their proper elevation. The sand was removed from the piles by compressed air, and then the three standard 10-in. 49-lb. H-column piles were driven with a drop hammer to obtain maximum penetration. So hard was the driving that the heads of the piles were battered by the blows and had to be cut off several times.

Following the driving of the piles, the lower sash brace was placed and tack welded. The piles were then cut to grade and a temporary 12x12-in. by 36-ft. wood cap placed on the piles for supporting the pile driver and to provide a working platform. Two 12-in. channel-iron caps were hung and the bent was ready for X-bracing. The two brace piles were driven, brought into position and welded. The longitudinal struts were placed, the bent sway-braced and the trusses hung. The X-braces under the deck were placed and a carpenter crew laid the wood deck.

After completing the steel work on a bent, the cylinders were watered and the concrete poured. Placing the concrete was done through pipes.

Heavy Seas Impede the Work at Times

The welding was carried on in conjunction with the pile driving and steel erection. All braces were tacked in place and welded. As the welding on each bent was completed, the temporary framework was moved ahead and welding started on the next bent. It was absolutely necessary to complete the welding of each bent before moving ahead, as any work not tied together would be knocked down by the heavy seas which came without warning. About 24 hours were required for welding each bent of the pier.

The welding was carried on almost entirely from "bosuns' chairs" and work was seriously hampered by rolling seas. The welding of the bottom braces was done under particularly trying and hazardous conditions. It was often necessary to place one man to watch the seas and warn the welders and workmen to start climbing when a large wave came along. A diver followed the welders and placed the underwater clamps, which hold the brace piles to the center pile of each bent.

All materials used in construction had to be handled over a 50-ft. bluff with a 100-ft. boom stiff-leg derrick and carried out on the pier on cars pushed by a small locomotive. Concrete materials were handled in skips loaded on cars and pushed out behind the concrete mixer, also mounted on a car behind the pile driver.

In order to transport the cement from the storage silos at the plant to the ship, a 6x7-ft. tunnel, 360 ft. long (see Fig. 3), was driven from the silos to the shore end of the pier. Two 12-in. pipe lines carry the cement, which is pumped from the silos through the tunnel and along the pier to the ship.

A 36-ft.-square pier head was constructed at the sea end of the pier. This was supported by four 7-ft.-diameter cylinders anchored into the shale by six H-piles driven in each and filled with concrete. The cylinders were placed 36 ft. apart to form the square and were tied together with structural steel, all welded.

Underwater Cutting Used in Constructing Pierhead

Placing the cylinders for the pierhead required driving falsework piling and 34 steel H-beams, which later were cut off at the ground line by a diver using an oxy-electric underwater cutting torch, with current generated by a 300-ampere arc welding machine.

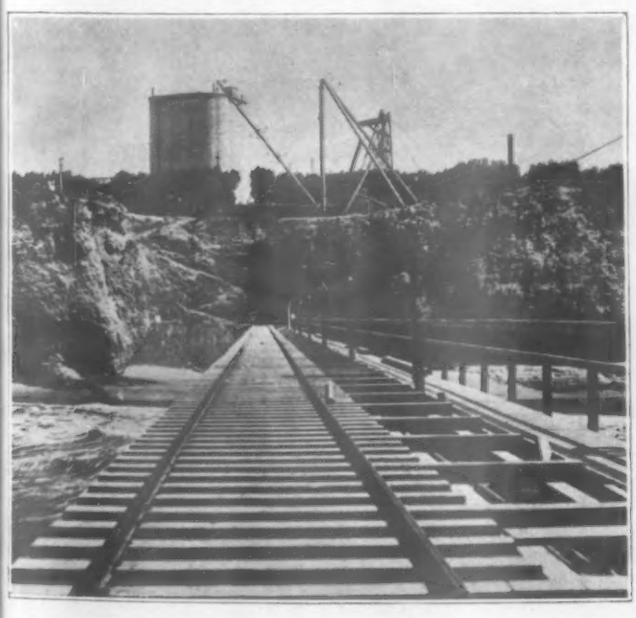


Fig. 3. Looking Inshore. Cement Is Transported From Silo to Ships Through Two Pipelines Which Pass Through 360-Ft. Tunnel and Are Carried Along Pier.

When a ship is taking on a cargo at the pierhead, it is necessary that it lay free of the end of the pier in order to prevent the ship from being driven against the pier by the ever-present ground swells rolling in from the sea. The ship is held off the pier by eight moorings, consisting of old-fashioned 16,000-lb. stock anchors, with 60 fathoms of chains, supported by a buoy. To give the anchors a hold on the bottom, holes were dynamited in the shale for the flukes. Of the eight moorings, four are provided for the bow and four for the stern of the vessel. These moorings are placed so that the ship's bow is held head on into the seas.

A small derrick at the end of the pier handles the two 12-in. hose from the ends of the cement pipelines to the ship. Each 12-in. line carries 1000 barrels of cement an hour.

The design and construction of the pier was carried out by the West Coast division of the Merritt-Chapman & Scott Corp., with R. C. Helen in direct charge of operations for the contractor. Parson, Clapp, Brinkerhoff & Douglas, of New York, were consultants in working out the design. The Lincoln Electric Co., of Cleveland, Ohio, were consultants for the welding operations and supplied the welding equipment.

Makes 8-Months' Trip Around the World

J. H. Edmundson, founder and managing director of The Acetone Illuminating & Welding Co. Ltd., Napier, New Zealand, who with Mrs. Edmundson is making a trip around the world, will be back in New Zealand in February after an absence of eight months, during which time they visited Egypt, various European countries, and spent a short time in the United States. Last year Mr. Edmundson's company celebrated its 25th year of service, and issued a "Silver Jubilee" booklet describing the growth of the company and showing the officers and the works in Napier, Auckland, Wellington, Christchurch, and Dunedin.

Purdue Registration Tops Four Hundred

A total registration of 401 was chalked up at the welding conference at Purdue University, Dec. 13th and 14th, instead of 185 as given in the December issue of *The Welding Engineer*. This is an increase of 74, or almost 25%, over the previous high-water mark of 327 that was established at the 1933 conference. Eight states and 186 different firms were represented among those registered.

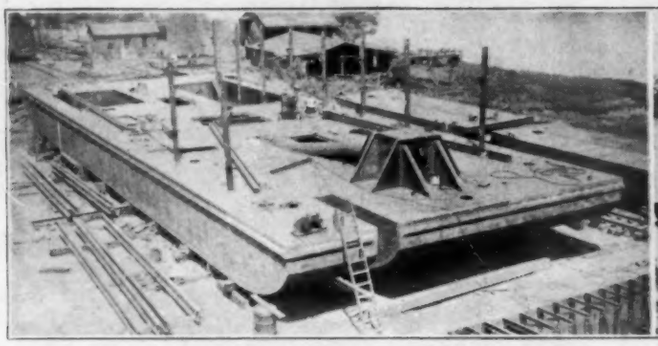


Fig. 1. Sand-Discharge Pipeline Can Be Seen Where It Enters the Head Framing.

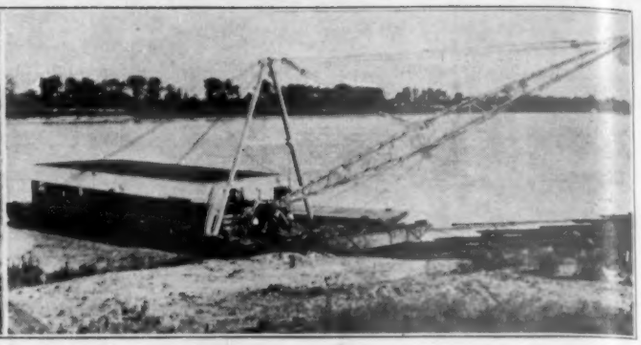


Fig. 2. Completed Barge, With Boom in Position.

All-Welded Barge

For Dredging Operations . . .

■ By D. BRUCE JOHNSTON

An all-welded barge, carrying a welded pipeline for discharging sand, in connection with dredging operations near Galveston, Texas, was recently completed by the St. Louis Shipbuilding & Steel Co., of St. Louis, Mo.

A general view of the barge in process of construction is shown in Fig. 1. The overall dimensions are: length, 110 ft.; width, 40 ft.; and depth, 7 ft. The barge is to be used as a floating workshop and also as a means of carrying one end of the floating pipe that comes from the dredge.

The pipeline passes through the center of the barge and can be seen emerging above deck at the near end, in Fig. 1. Here it enters the head framing, in which there is a ball joint to allow the next section of pipe to pivot. From this point, 200 ft. of pipe is supported by a 100-ft. boom, also completely welded, which extends over the river bank, onto which the dredged sand is discharged. The head framing serves to take the reactions from the boom and pipeline. Fig. 2 shows the completed barge with the boom in position.

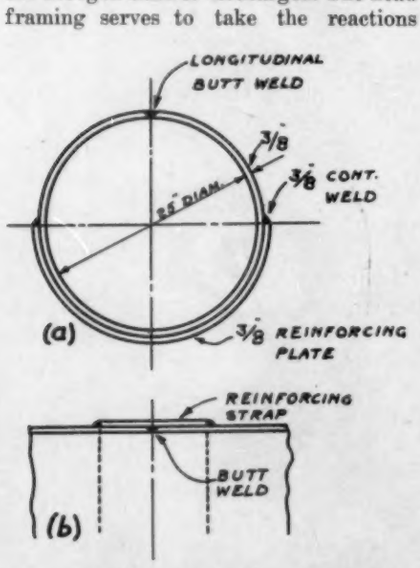


Fig. 3. Details of Pipeline Construction.

The pipeline is made of 0.35-carbon steel plate, ⅜ in. thick, and is 25 in. in diameter. All the joints are butt welded, the runs being made with a ⅜-in. electrode in one pass. The lower half of the pipe is reinforced as shown in Fig. 3(a), by means of another ⅜-in. plate, which is fitted to the bottom and lap welded as shown. The object of the additional plate is to prolong the life of the pipe, as it is estimated that by the time 30,000,000 cu. yd. of sand has been discharged, the bottom of the first plate will have been worn through. The circumferential butt welds are reinforced with cover plates as shown in Fig. 3(b).

Except where otherwise mentioned, all plating in the barge is 5/16 in. thick and all joints are lap welded with ¼-in. fillets. The transverses are built up of rolled sections and there are two plate longitudinals set at 6 ft. on each side of the center line.

Two compartments are built in each side of the barge for oil storage. Every compartment was tested for leaks under air pressure of about 5 lb. per sq. in. As a safety measure, in addition to the use of a pressure gauge, the maximum pressure was controlled by a column of water approximately the height of the barge. The usual method was employed of painting the welds under test with a solution of soap and water, by which means any leaks would be very readily discernible.

The deck forms the floor of the workshop, and the walls of this shop are of ⅛-in. plate welded to the columns, some of which are shown in position in Fig. 1. These columns, which are of rolled sections, extend through to the bottom of the boat and are framed into the transverses, to which they are welded. They also serve

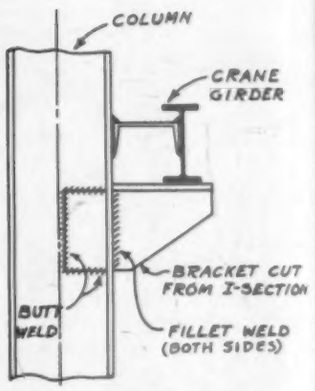


Fig. 4. Detail of Welded Bracket for Supporting 5-Ton Crane.

to carry brackets, on which rest rails for supporting a 5-ton crane. A detail of these brackets is shown in Fig. 4. A portion of the flange and web of the column is cut out and into the space thus formed is fitted the bracket, which is cut to shape from an I-beam. The web of the bracket is then butt welded to the web of the column and also fillet welded to the flange, as shown in the diagram.

Fig. 1 shows two openings in the farther end of the barge. In one of these is set an oil-engine-driven generator of 1600 hp. capacity, for operating the dredge. In the other opening is set an auxiliary generator for supplying power to the workshop and for lighting purposes. Both these machines are carried on the transverses, which are reinforced at these points.

The bilge plate consists of an angle welded to the side and bottom plates. The rubbing bar seen near the top of the barge in Fig. 1, consists of bent plates welded in place. The bollards are welded to plates, which in turn are welded to the deck plating.

Shielded-arc electrodes were used throughout.

Get "*H. O. T.*" on Welding

■ By H. O. T. RIDLON

[This section is dedicated to Better Welding and Better Welding Shops. Suggestions and criticisms are invited.]

So. You Won't Talk. Eh?

Perhaps this should be titled "Out of the Scrap Pile," because it is the story of a welding shop that was virtually pulled out of the scrap pile. This story was the cause of last month's thought for the month, remember it? It was, "No Depression Ever Killed an Opportunity."

Oke, so you mugs won't talk. All right, that suits me fine because I know the story as well as you do, and most of my living is derived from talking and knowing when not to talk.

Cullom is a town down in the corn belt of Illinois with a population of something slightly more than four hundred. In it are four so-called Job Welding Shops. Doesn't look like much of an opportunity to make a living, to say nothing of a darn good one, and most particularly when there isn't an industry within thirty miles. Well, it was done, and can be done by any "real welder" that knows his stuff, and can get one hundred farm customers. But believe you me it isn't done by sitting about waiting for it to roll into your shop. It is done by going out and selling.

On December 15, 1933, six feet four inches and two hundred and thirty-five pounds of man walked into The Hirstein Brothers Welding Shop in Cullom, Ill., to collect thirty-five bucks that was months and months over due. They could not pay, and there was no way that they could see of digging up to pay off. Well this big egg tells 'em that they're nuts; that any guy that can weld as well as they can, that knows all the farmers thereabouts, and is willing to work can make a darn good living. Well, the oldest brother, Eldon, thought that this fellow had gone completely loco. The younger brother, Marvin, reasoned this way: Well, we sure are not getting any place the way we have been going. Perhaps this mug is right. Let's listen to him, and if it is at all possible let's give his ideas a trial. So they closed shop for the day, and went over to "Shorty's" for a hot meat sandwich. Well after they had finished eating, they pops and wants to know what it is going to take to do it.

Well, it isn't much—a good welding outfit, a forge, an anvil, a few hammers, a few pounds of Borod, a shop, a telephone, a fountain pen, some 3x5 in. file cards, an old flivver that will run, and the will to do. That didn't seem impossible, for they had everything but the 3x5 cards and the Borod.

They had most of these things, as has any welding shop, so they figured out that they would be able to get the balance of them; therefore, that the thing to do was give it a shot. So they went back to their shop, closed up the joint for the afternoon, first rearranging the shop so that one could work more efficiently. There was an old windmill that was down that could be had for removing it. They took the cutting outfit and cut the thing up so they could move it, brought it into the shop and made some racks, got some black paint, and in a few hours they had a swell-looking joint, with things painted up and the walls whitewashed. They found an old broken-down sign painter that happened to be sober enough that day to make some signs, the main one being, "No welding job done for less than 50c." Then they figured out some simple cost cards. The local news sheet was willing to print these for them and put it on the cuff until they were able to pay. (They were paid for before the end of the month.) Then they spent a buck for one hundred penny postal cards. So the next thing to do was build a sales program and decide what was the best selling bet. This, it was decided, was hard-surfacing of plow shares.

The next thing was to compile a list of all farmers by roads for ten miles about Cullom, and figure about how many calls they could make per day. Then they sent out cards each day saying that Marvin would be going by their farm on such and such a day, and if the farmer would 'phone them before a certain time on such a day, they would bring out from town anything the farmer might need. Of course, they followed through on this, and on that day Marvin started out in his flivver, stopping at every farm, delivering anything that they might have asked him to bring to them, then going into a sales talk that was carefully built on rebuilding and hard-surfacing of plow shares. After the first four hours out, he came in with $76.00 worth of work. It worked so well that they kept it up. Some days were not that good and some were better.

The way that these boys figure the cost to the customer is that they take all the costs that go into the job, such as labor, gases, rod, cartage, etc. If these totaled, say, $1.00, they would take 50% of this for overhead, so that this totals $1.50; they take 50% of this for profit, or 75c, which makes the cost of the job to the customer $2.25. This is the way they figure all jobs, and with the same customers, and believe it or not, they are now getting ten and twelve dollars for jobs that they used to charge five or six for. You say it can't be done? Well, sir, it is being done. And I say, what is the use of doing work of any kind if you don't make a profit on it?

Most of their jobs are small, but they get a few large castings now and then, and have had a few semi-trailers to build or rebuild, some State and County road work on grader blades, snow plows and things like that which has showed them a nice profit. But each and every job, large and small, must carry its share of the overhead and show a profit.

When they started this a year ago last December they were renting their shop. Since then, they have bought a lot across the street and have built their own shop. It was not large but it was built to be an ideal small Welding Shop. Since then they have had to build an addition. I can't give you any idea how many shares they did last spring or what their business totaled for the year in dollars and cents. But they have their lot and shop nearly paid for, have a new Ford truck, and this fall they worked on more than 1500 plow shares, and most of these were hard-surfaced, for which these kids collect four hard cold bucks apiece. You say it can't be done? But it has been. But it wasn't done by sitting around waiting for it to come in. They went out and got it. The fame of these kids spread so that they had plow shares sent to them from ninety miles away. Still they went out and brought them in, and when Mister Farmer wanted his plow shares they were ready for them in Hirstein Bros. Welding Shop. And they managed to dig up the cash to pay for them. Out of these fifteen hundred shares that they had in their shop last fall there were only about four sets that were not called for, and the rest were all cash on the line.

Now, Eldon tells me that he has a bet with some one that he will do more plow shares in 1935 than in 1934. And knowing that young fellow like I do, I'll take part of that bet.

• • •

"I & W," the other magazine of this industry, has a new line this month, I understand, by one who calls himself H. A. G. I salute you, my very good friend, may we have many laughs with you.

• • •

The Purdue Welding Conference was, as usual, good. You guys out in Iowa don't pass up the one at Ames; and you fellows in Ohio, there is one coming at Columbus.

• • •

No, sir, I do not like "Romeo and Juliet." Lovers get nowhere. I fear I must be a very practical man.

• • •

The thought for the month: The will to do is the first requisite for success.

Welded Girders and Deck for Highway Underpass

Welding was used in the recent construction of the girders and top deck of an underpass where the Burlington Railroad passes over U. S. Highway No. 281, in Hastings, Nebr. The structure, which involved 467,267 lb. of steel, was built jointly by the railroad and the state department of roads and irrigation. Construction was begun early in the spring of 1934, the first trains crossed the structure about Sept. 1st, and the highway was opened to traffic on Nov. 12th. The total cost was aproximately $100,000 for the structure proper, and an additional $46,000 for the connecting pavement. Seven tracks over the structure handle the main-line traffic of the C. B. & Q. R. R.

The structure consists of nine parallel girders, each made up of four 36-in. 182-lb. I-beams, laid parallel and joined

Moving One of the Nine Girders Into Position.

by 24x27x⅜-in. web plates spaced 4 ft. 6 in. apart. The girders are entirely welded, with the exception of the end webs, which were riveted in the shop. All the other web plates are attached to the beams at their ends by means of ⅜-in. fillet welds. These girders have 1656 ft. of shop welding and 416 ft. of field welding, all ⅜ in.

The top deck, which is entirely welded, consists of ⅜-in. wrought-iron plate, made up in strips 7 ft. 6 in. wide and 46 ft. long, each strip consisting of four sheets, two being 13 ft. long and two 10 ft. long, welded together at their ends. Each of the 46-ft. strips covers one of the girders, and is welded to the girder by means of a great many 15/16-in. plug welds.

The edges of the sheets were beveled for welding. No provision was made to prevent buckling, as wrought-iron joiner strips, each 18 in. wide, pressed into a U-shape to form a drain trough, are welded between the wrought-iron strips. The drainage capacity of each trough is about the same as that of a 6-in. pipe.

After the deck was welded, the troughs were filled with cinders and an asphaltum spread over the entire deck. Over this was then spread a layer of cinders and gravel to form the road bed. Another trough is welded at right angles across each end to carry all the water entirely

Girders in Position for Welding.

off the structure. The welding on the deck constituted 320 ft. of shop welding and 1024 ft. of field welding.

The field welding, totaling 560 man-hours, was done by the Weber Machine Works, of Kearney, Nebr., and Hollup No. 30 Rex electrodes were used exclusively, these being supplied by the Balbach Co., of Omaha. Carl Randecker was the welding foreman on the job. The shop welding was done in the plant of the American Bridge Co.

Prevents Freezing of Acetylene Generator

How can we protect our acetylene generator against freezing during cold winter nights when the outside temperature drops down to zero or lower? That problem, which confronts many job welding shops, has been solved by George Wolf, proprietor of the Fostoria Welding Co., Fostoria, Ohio, by building an inexpensive heating system, using only a welding and cutting torch for tools.

Mr. Wolf bought an old coal-burning heating stove, which was obtained cheap because the firepot was broken. The firepot wasn't needed, so it was removed, leaving only the base containing the grates, and the upper shell.

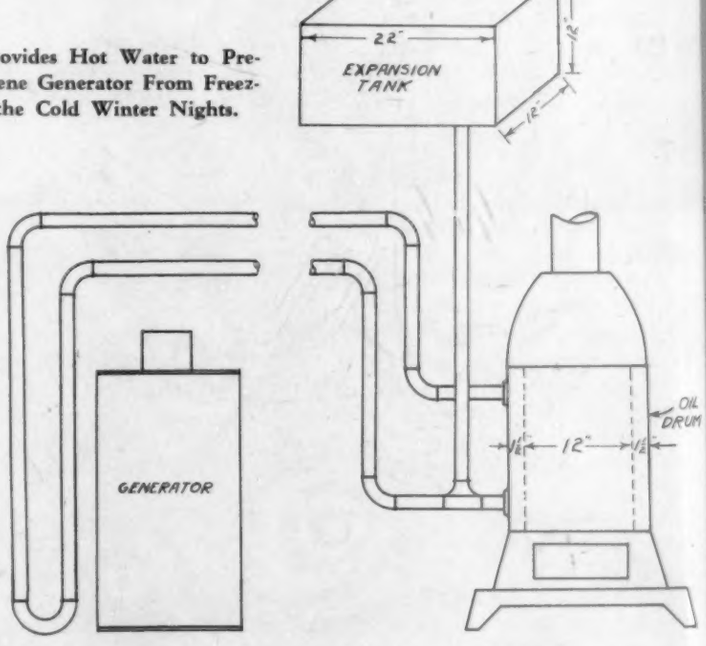
Next an oil drum—one of the smaller ones, 15 in. in diameter—was obtained and thoroughly cleaned out and steamed so it could be flame cut and welded without danger of exploding. A hole was cut in each end of the drum to receive a 12-in. pipe, of the same length as the drum. This pipe was inserted into the drum and the ends welded to the drum heads, thus leaving a space of 1½ in. all around the pipe between it and the drum. Then an outlet nipple was welded into the drum near the top and another nipple welded into the drum near the bottom for an inlet.

This unit was then placed on the base of the stove, after removing the upper part of the stove, and then the upper part, or shell, was placed on top, as the diagram shows. The assembled unit was then cemented thoroughly. A pipeline, assembled by welding, was run from the upper nipple over to the generator, then back to the lower nipple, the outgoing line being of 1¼-in. pipe and the return line of 1-in. pipe. Both lines were welded to their respective nipples. A vent valve for discharging trapped air was welded into the pipe at the highest point.

Another line was welded into the return line near the heater and was run up to an expansion tank, located higher than the highest point in the piping system. This was an open-top tank, 22x12 in. and 12 in. high, made of steel plate with all seams welded.

With the piping system and tank com-

The Heater Provides Hot Water to Prevent the Acetylene Generator From Freezing During the Cold Winter Nights.



pleted, all the pipe as well as the tank was filled with water. Care is taken that water is always visible in the expansion tank, as this insures a full system and makes possible the absorbing of any back pressure that might be generated in the system. The water is heated and circulates in the same manner as in any hot-water heating system.

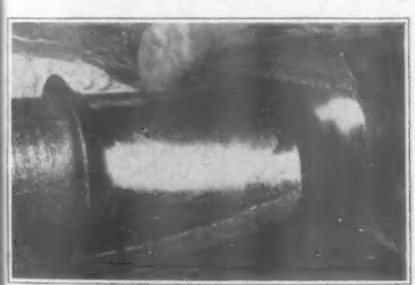
In severely cold climates, it might be advisable to build a small room of plaster board completely enclosing the generator and heating coil. Even though the fire in the burner goes out during the night, the water will retain its heat for quite some time.

$2000 Saved by Repairing Mixer Rotors by Welding

Two thousand dollars was saved by the building up and hard-surfacing of the large rotors of a No. 12 Banbury mixer. This type of mixer is used extensively throughout the rubber industry, for mixing a heavy composition, including a large proportion of silica sand, and hence such mixers are subject to severe wear. Each of the two rotors is approximately 15 ft. long, and 18 in. in diameter through the largest part of the fins.

At the time of repairing these rotors, the fins had worn down approximately 5 in. at their highest point, and the bearing surfaces were worn down approximately 3/8 in.

The fins were rebuilt back to their original dimension with 0.75-carbon electrode, and then the entire wearing surfaces were covered with 3/16 in. of hard-surfacing material. The bearings were rebuilt with the same high-carbon electrode, and then machined 1/16 in. undersize; then hard-surfacing was applied



Mixer Built Up and Hard-Surfaced.

over the machined surface, to a thickness of 1/8 in., after which the bearings were ground smooth to fit.

The total cost of the job was $1000, and it would have cost $3000 to replace both rotors. A total of 100 lb. of hard-surfacing material was applied.

These hard-surfaced rotors were recently examined, after having been in service one year. It was found that the hard-surfacing had not worn appreciably, except at the extreme high points, where the surface had worn off to a depth of about 1/2 in. The surfaces not hard-faced had worn down 3/16 in., leaving the hard-surfacing sticking up 3/8 in. It was necessary therefore to hard-surface the low spots, after which the machine was

Grinding Down the Hard-Surfacing.

put back in operation, and is giving satisfactory service. The building up and hard-surfacing was done by the McLean Welded Products Co., 520 West 79th St., Chicago, Ill.

Large Contracts for Steel Tunnel Forms

The Metropolitan Water District of Southern California has awarded contracts to the Consolidated Steel Corp., and the Western Pipe and Steel Co., of Los Angeles, for the fabrication of a large quantity of all-welded steel tunnel forms for use by different contractors in construction work on the Colorado River aqueduct. These huge forms are of the newly-developed collapsible type.

Sprayed Zinc Coatings for Marine Purposes

Sprayed molten zinc coatings are giving satisfactory service in marine work, says Dr. Leonard Pessel, technical director, Metals Coating Co. of America, as reported in a recent issue of the *A. E. D. Bulletin* of the Air Reduction Sales Co. Dr. Pessel offers the suggestion that a thin zinc coating of 0.006 to 0.008 in., with additional protection of paint, should offer much longer life than paint by itself and should require a much less frequent number of maintenance operations. Paint does not adhere readily on surfaces that have been dip-galvanized. Sprayed zinc coatings, on the other hand, have a peculiarly granular surface, which offers an extremely strong bond to subsequently applied paint, and, says Dr. Pessel, paint will show a much longer life on top of sprayed molten zinc coatings than it will over plain iron or over a galvanized surface, as a number of experiments have brought out.

"Naturally, zinc will be attacked in the course of time by the salt water, and the length of life of the coating will depend on a number of rather unpredictable conditions—for instance, the extent of abrasion to which the coatings are subjected," Dr. Pessel reports. "The average thickness of sprayed molten zinc coatings for this type of service should be about 0.008 to 0.010 in. Sprayed molten cadmium coatings have generally stood up under marine conditions better than sprayed molten zinc, but the cost of cadmium is much higher than that of zinc. We believe that for work of this character, the economic advantage would be on the side of zinc."

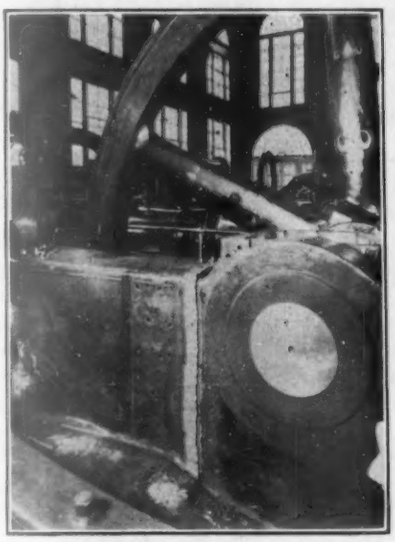
Arc Welding Salvages Expensive Equipment

A broken engine frame of a compressor in a large St. Louis packing plant resisted all efforts to repair it. Expensive delay threatened. Plant officials visualized spending $5,000 for a new frame.

An arc-welding operator was called in. Examination of the break revealed a crack extending 3 in. vertically and 2 in. horizontally. Preheating the part was impossible, owing to its close proximity to the bearing.

The arc welder set to work. Pairs of 3 1/2-in. diameter studs were grouped every half inch along the break. On top of the frame, studs of the same thickness were spaced 2 1/2 in. center to center. All studs were welded together, care being taken not to melt them by overheating.

When the arc welder was through, the compressor was immediately returned to



Welded Repair of Broken Frame.
(The holes visible in the frame were left from previous attempts to stud patches on the break.)

service and has performed satisfactorily ever since. The total cost of the repair was $350.

The accompanying illustration shows the part after a year's service. The welding was done by the John Nooter Boiler Works, St. Louis, with equipment supplied by The Lincoln Electric Co., Cleveland, Ohio.

Making Smooth, Uniform Flash Welds

By A. M. MAC FARLAND

The flash welding of large sheets, such as for automobile bodies, is a game for experts. The finished appearance of the weld depends on various factors, some of which are generally considered as uncontrollable. However, there are some engaged in this business who are able to weld their sheets so that the seam will finish down to a smooth surface, ready to paint, while others meet with trouble in trying to obtain smooth seams.

The Brinell hardness of the metal in the weld and adjacent to the weld is being regulated to exact specifications by one large company who makes a practice of flashing together two of the largest sheets they can buy, to make one large stamping. They find that a uniform hardness of sheet and weld is desirable in order that the weld will finish down without showing a line through the paint. The hardness is being regulated by juggling the time of heating and of cooling and other factors.

In this kind of work, the making of a smooth, strong weld depends on refinements of detail. One manufacturer, famous for the excellence of his welds, credits the operating cams for the superiority of his work. He states that some machines do not have the right speed of follow-up and do not follow the work properly as the edge fuses.

Another company found that many of their troubles vanished when they gave more attention to obtaining uniform thickness of sheets.

Kappertz is Treasurer of New Jersey Association

The article in the December issue of *The Welding Engineer* regarding the New Jersey Association of Welding Contractors erroneously gave the name George A. Capus as treasurer of the Association. The treasurer is Leo Kappertz, who was recently re-elected to this office to serve another term. Mr. Kappertz is proprietor of the Morristown Welding & Radiator Co., Inc., of Morristown, N. J.

Meeting of Metallurgical Advisory Board

All those interested in metallurgical research are invited to attend the eighth open meeting of the Metallurgical Advisory Board to the Carnegie Institute of Technology, to be held on Feb. 8th, at the Carnegie Institute in Pittsburgh. The program includes reports, papers, and discussions, beginning with an Address of Welcome, at 9:15 a.m. by Dr. Frank N. Speller, chairman of the Metallurgical Advisory Board, and ending at 7 p.m. with an informal dinner, at which J. Steele Gow, director of the Falk Foundation, will speak on "Research in the Economic Field." A number of the papers pertain to steel-making processes, in particular the deoxidation of steel and its effect on aging and impact strength, and the control of iron oxide in the basic open-hearth process.

A Welding Engineer's Wife Speaks Her Mind

■ By ONE OF 'EM

Tough Break

"Whitey" Maurath's welding-rod factory burned down Christmas morning. Roof caught from a spark somehow, and the place was gutted. We went down to see if we could do anything to lend a hand, and found four steaming concrete walls and nothing else. All the machinery was gone and the floors and roof were in sagging ruins. "Whitey" was in the hot-dog stand across the street, gazing at the ashes of a large part of his life's work, and trying to think it all out over a glass of ale. It was a pretty bad break, what with stocks low, and orders coming in and no way to make up the stuff. "Whitey" built up those machines himself, piece by piece, and they will have to be replaced in the same way. But the Old Boy landed on his feet and already had it figured out. He will have to work day and night to rebuild his plant if he is to get into operation again next week, as he plans. (This is being written on January first.) But he will do it. It takes the stuff, to be in the welding business.

* * *

The Smart Ones Do It This Way

My husband had occasion to visit a large Cleveland welding plant this week. This shop has 121 operators welding automobile parts, and is widely known for its model welding department. The product is good, and the company has a long record of peaceful working relations with its men.

The superintendent took my husband down the long rows of welders at work, and stopped to introduce a few of the men and to comment upon the welding. "These men," he said in an aside, "are the company's best assets. We are proud of them and they know it, and they turn in uniformly good work. We have very few rejects and in these cases the men want to know why they failed and to correct the difficulty."

Anyone who has ever worked with careless, indifferent men or deliberate slackers will recognize this attitude as unusual, and that it reflects exceptional feeling toward management. The superintendent in this case happens to be a fine type of overseer, one that is happily becoming more common in industry. It happens that he, in turn, reports to a chief who shows him the same respect and confidence he passes on to his men.

There was a time, not so long ago, when industry sought to prosper although working conditions were inhumane, and fear and distrust existed between the ranks of men. This system is giving way to a better method of getting results together. The model Cleveland factory is an example of sane management applied to the human side of welding problems.

* * *

Stack o' Wheats

Some people were sitting around at our house the other night and the talk got around to the subject of food. We were telling what we liked best to eat, and it was really funny about the men. With one exception (and he was a chap who can never get enough shad roe with bacon) all the men said they hankered oftenest for buckwheat cakes, smoked country sausage, and real maple syrup.

It was, they agreed, an outrage that when you go into a hotel or restaurant and order buckwheat cakes with trimmings right off the bill of fare, the stuff they bring you is not that at all. These phony buckwheats are not the stout-flavored, sweet-sour, golden discs we all remember from our childhood. They are a puny apology for those old-fashioned griddle cakes that made you hurry down to breakfast on winter mornings, as soon as the savory smell of them rose to your icy bedroom.

All the men at our party had the same story to tell: Mother set the buckwheat batter at night, and let it rise in a dark-brown crock which she set on the flat top of the base-burner. During the day the top of the heating stove was crowned by a nickeled ornament, but at night this was pushed aside and the buckwheat batter placed there to rise to foaming heights by breakfast time. Often there was a skillet full of sizzling country sausage to accompany the griddle cakes, and it was not the finely ground mess of cereal with outlandish spices that masquerades as sausage today. In those days sausage was good fresh pork, coarsely ground and seasoned lightly. Maple syrup, too, came from the sap of the maple tree, and had a soul-stirring flavor that no Louisiana cane-field ever yielded.

All these mockeries have got to stop. What this country needs is real buckwheats and sausage and maple syrup once more. We've had enough of these infernal imitations.

Cutting Set-Up Time on Assembly Fixtures

By FRANK McKENNA
Production Manager
Detroit Stamping Co.

One of the major problems confronting the sheet-metal production engineers of today is the elimination of stray costs that arise from incalculable forces, such as buckling of parts and difficulty of handling. Numerous devices have been tried out for the purpose of holding down the work to ensure alignment or to permit of the working out of succeeding

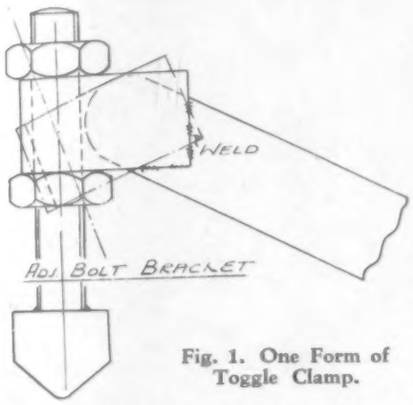


Fig. 1. One Form of Toggle Clamp.

operations as occur in the assembly of automobile bodies, refrigerators and kindred assembled articles.

Perhaps the simplest way of aligning two members is to use pilot pins, locating either by holes in the part or nesting at corners. When working with sheet metal however, it is necessary to use something additional to hold the stampings or sheets against the form to prevent excessive buckling while welding or to avoid slipping of parts when riveting. The standard C-clamp is used frequently in this capacity and is invaluable for short-run jobs. Present-day mass production set-up, however, requires a clamping device that locates each and every time in the same spot with uniform pressure, and —last but not least—ease and speed of handling.

Another work-holding device is the cam-action clamp, which is simple to make and install, having the main advantage of price, but a disadvantage in that it is apt to fly open on the fixture if a sudden jar or impact occurs.

Well known to the designing and toolmaking elements in Detroit and Philadelphia areas is a quick-action clamping device known by various names—"grasshopper," "rapid action" or "toggle clamp." Naturally its mechanical principles have been known for years, but common usage seems to have started around 1920 when metal fabricated bodies for automobiles became quite a production factor in the large automotive plants.

The cardinal principle of this toggle clamp is that the handle and the clamping bar travel on two distinct orbits, the orbit of the handle being twice the diameter of the clamping-bar orbit. The location of the pivot points of these two orbits in relation to each other is also quite a factor in design, the speed of the bar and the travel of the handle being in direct relation to all these points. The bearings have to be without excessive play, because, owing to the leverage principles of construction, looseness is amplified considerably at the pressure end of the bar. By comparative tests made over a long period of usage, it has been found that hard bronze bushings stand up better to the compressive and shearing stresses induced by the action of the bar when exerting pressure, rather than a soft-steel straight pin. The bushing acts also as a spacer and is stationary, the members rotating around it.

One point that causes considerable trouble in the shop when fitting the assembled clamp to the fixture or device is the adjustments required to be made after all parts are screwed and dowled, due to the springback of the part or possibly an error in laying out the job. A simple remedy is to use a stud bolt with a nut on each side of a separate bracket, the bracket to be held in place on the toggle bar by friction until all parts are lined up, and then welded to the toggle bar in the desired position (see Fig. 1).

The toggle clamp (Fig. 2) combines the cumulative experience of tool shops in this vicinity extending over a period of years. As will be seen, movement of the handle through 80° results in the bar moving through a 160° arc.

At first glance it would appear that the mechanical advantage is in favor of the toggle bar in consequence of its longer motion. This however is not so, as a glance at the diagram will show. Seventy per cent of the travel of the handle is comparatively without effort because it is merely traveling to the work. The bar for this period travels approximately three times as fast as the handle. From this point on, the handle travels increasingly faster than the bar, at the final 5° of travel having a mechanical advantage of 12-to-1. To obtain this combination of speed and power, the pivot point of the toggle bar must be on a line with or above the point marked *X* in Fig. 2. This design, with the links on the outside and the location of pivot points as on the clamp shown here, gives the advantage of equal or greater pressure at the toggle bar, plus the very important advantage of the full clearance of the hold-down point from the work, when open, with only a short movement of the handle.

The toggle clamp as shown is a clean-cut stamping job all the way through, well engineered, giving high compressive and tensile values, yet has the advantages of being light in weight and very durable—a clamp that will help to cut set-up time on assembly fixtures of all sizes and for every industry.

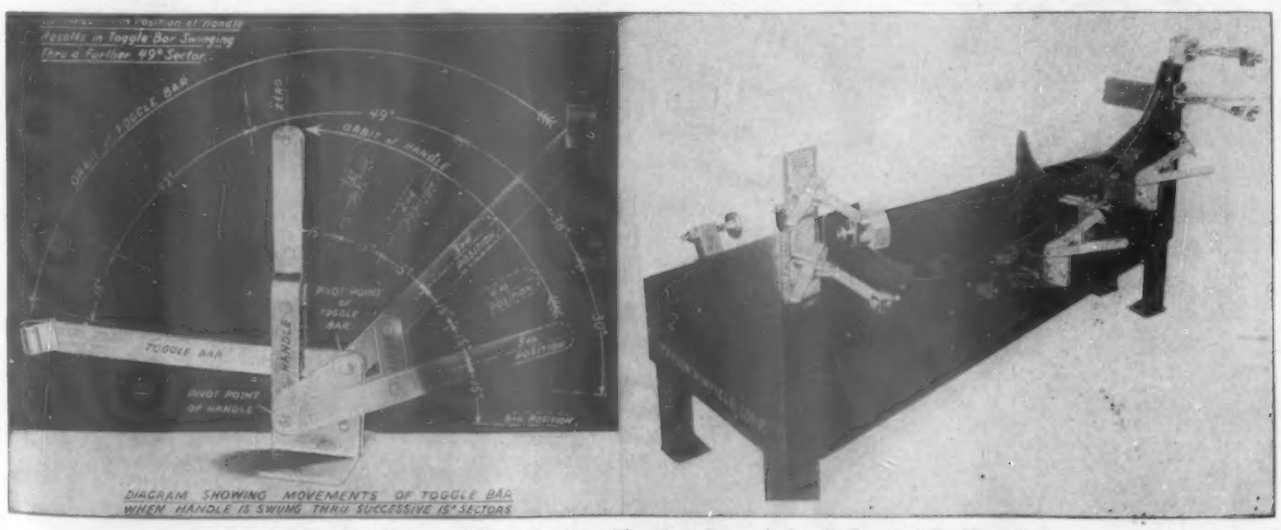

Results in Toggle Bar Swinging
Thru a Further 49° Sector
49°
ORBIT of HANDLE
TOGGLE BAR
HANDLE
PIVOT POINT OF TOGGLE BAR
PIVOT POINT OF HANDLE
DIAGRAM SHOWING MOVEMENTS OF TOGGLE BAR
WHEN HANDLE IS SWUNG THRU SUCCESSIVE 15° SECTORS

Fig. 2. Toggle Clamp of New Design, Showing Several Applied to a Machine Part.

Welded Soap Cooker of Nickel-Clad Steel

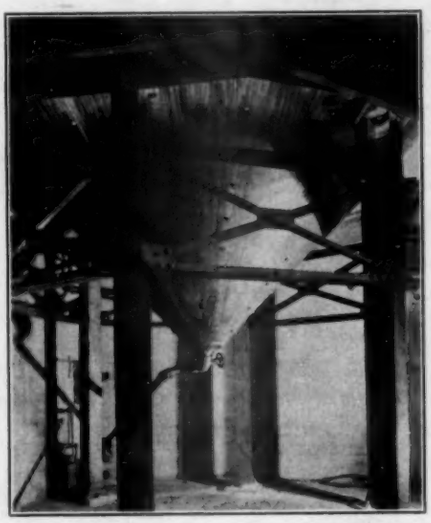
In the making of fine facial soaps, the objectionable discoloration and odor of the oils used, which have always been prevalent in other than alloy steel containers, had to be eliminated.

Notwithstanding the advantages that could be obtained from the use of alloy tanks, the cost of such a product has had a considerable bearing in retarding its adoption. Stainless KA2 was considered and adopted by some manufacturers only to the extent of small tanks, or to larger carbon-steel tanks which could be lined. Duralumin also was used, and some tanks were lined with monel metal. And now nickel-clad steel since its introduction about three years ago, has found its way into chemical plants, oil refineries, creameries, breweries, etc. Its value is becoming more and more apparent wherever corrosion or bacterial contamination is apt to take effect.

It was due to reasons of corrosion that the Jergens Soap Co. recently let a contract to the Southwest Welding & Manufacturing Co., of Alhambra, Calif., for the fabrication and field erection of a soap cooker for its Burbank, Calif., plant, made from nickel-clad steel.

The kettle, composed of four courses between its butterfly cover and conical bottom, is 15 ft. in diameter. The straight portion, from the top of the kettle to the top of the cone, is 22 ft. in height. The cone is 7 ft. high on the vertical, making a total height for the kettle of 29 ft. The cone was made from plates 3/8 in. thick, while the bottom vertical course plates are 5/16 in. thick, the second and third course plates are 1/4 in. thick, and the fourth or top course plates are 3/16 in. thick. The inside welds were made with Inco metallic-arc welding wire No. 31, while low-carbon-steel shielded-arc electrodes were used for the outside welds. All of the plates were clad with pure, solid nickel on one side to the extent of 10% of the total plate thickness, with black oxide finish on the nickel surface. The heating coils and the discharge spout are pure, solid nickel piping.

No marking or injury to the plate surfaces was allowed during fabrication, and hence great care had to be exercised. Edges of all plates for the cone were machine beveled for butt welding, and the plates were formed to shape on a large universal press. Particular care was taken to keep the rolls clean during the forming of the plates for the courses above the cone; lap joints were used for these plates, so no beveling of edges was required.



View of Conical Bottom of Cooker.

The knocked-down material thus prepared was erected alongside another cooker. Sufficient make-up holes for erection purposes were riveted with special nickel rivets. On completion, the tank was tested, disclosing a few pinhole leaks, which were rewelded, after which a gravity cold-water test was applied, and the tank then was approved ready for operation.

Since this cooker brings the oils to the boiling point, considerable expansion and contraction take place, but no difficulty in this respect has been experienced.

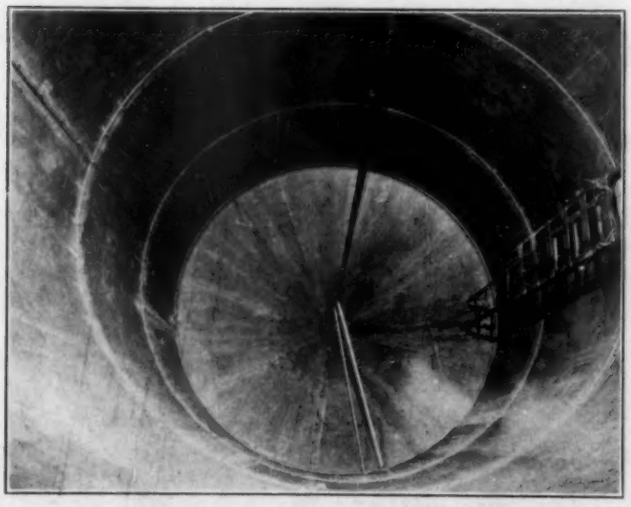
Compressed Gas Assn. to Hold Annual Meeting

The annual meeting of the Compressed Gas Manufacturers' Association will be held at the Waldorf-Astoria, in New York City, Jan. 21st and 22nd. Registration will begin on the opening day at 10:30 a. m. in the reception rooms of Le Perroquet Suite. A luncheon in the Astor Gallery will follow at 12:30, and at 2:30 the election will be held for officers and executive-board members, and reports of committees will be received.

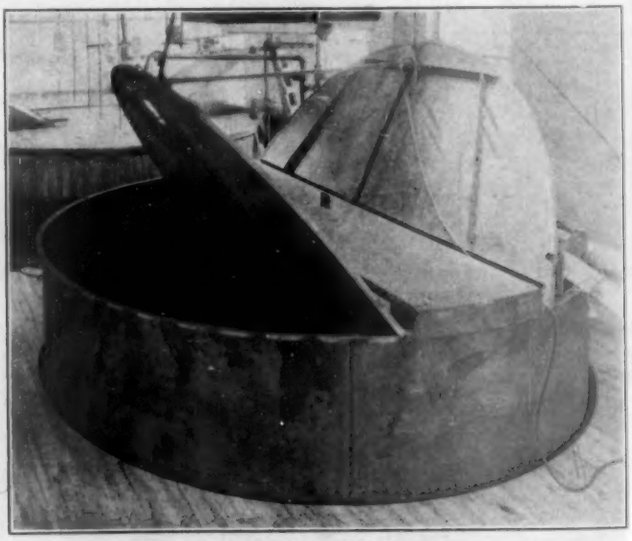
At 10:30 a. m., on Jan. 22nd, in Le Perroquet Suite, a symposium on air conditioning will be held. This symposium will be resumed at 2:45 p. m., at which several papers will be given on containers, their specifications, inspection and testing. The annual banquet will be held at 7:15 p. m. in the Bassildon and Jade Rooms.

Important speakers have been engaged for both luncheons. The speaker at the luncheon on the opening day will be John Tee Van who will tell of his experiences while with Dr. William Beebe he explored the deep recesses of the sea off the Island of Bermuda in the "Bathysphere." The speaker at the luncheon on Jan. 22nd is not definitely known, but according to the announcement, he will be a noted aviator.

The Association recently moved its headquarters from 110 West 40th St. to 11 West 42nd St.



Looking Into Cooker From Above, Showing Welded Seams in Nickel-Clad Plate.



The Butterfly Cover Also Was Welded.

Bronze-Welding a Large Cast-Iron Gear

An interesting bronze-welding repair job on a 6-ft.-diameter cast-iron gear was recently carried out by the Wayne Welding & Supply Co., of Fort Wayne, Ind.

The illustrations show the gear with a section broken out of the rim, the section

Gear With Broken Segment.

tack welded in place, and the job after welding. The breaks were melted out with the carbon arc, and grooved sufficiently wide to assure full penetration by the bronze filler rod. Before welding was started, the surfaces of the breaks were ground to assure clean surfaces that would alloy with the bronze and make a perfect bond.

Segment Tack Welded in Place.

Preheating was local in nature and was obtained by two torches burning city gas. The casting was not brought to as high a

The Completed Weld.

temperature as would be necessary when welding with a cast-iron filler rod. Two welding torches were used simultaneously during part of the welding operation.

This job consumed 295 cu. ft. each of oxygen and acetylene and 42 lb. of ¼-in. Rego bronze rod No. 67. The total labor time was 17 hours.

Builds Road Tampers by Welding

Rather than continue to weld broken road tampers that operate by compressed air, the Guarantee Welding Works, of Canton, Ohio, have designed and built an all-welded one for their customer, who is a road contractor.

The all-welded tamper is shown at the left in the illustration, and consists of a 6x6-in. base cut from a ⅞-in. steel plate. Four triangular reinforcing angles are cut from ⅜-in. steel plate, and the entire assembly, including a shaft from an old tamper, is welded together.

This tamper lasts much longer than the cast tamper which it replaces. One of the old tampers, without the shaft, is shown

The Welded Tamper (Left) Lasts Much Longer Than the Cast Tamper (Right).

at the right of the illustration. The break usually occurs at the point where the shaft is shown to be cut off. The Frew brothers, who operate this shop, state that the shaft can be welded to the cast base, but the life of the repaired tamper is short.

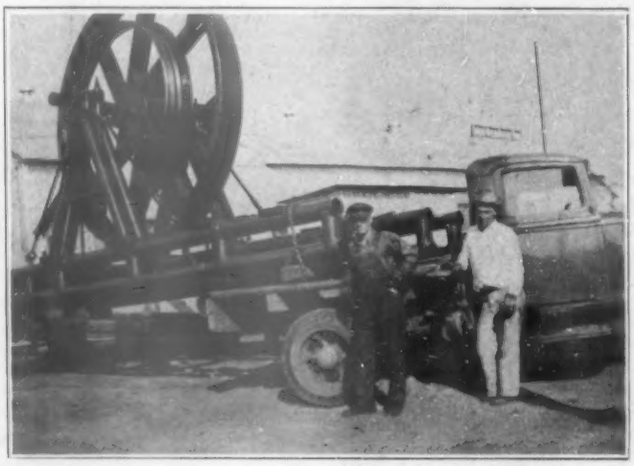
Portable Welded Structure for Oil-Well Drilling

A welded pipe structure has been developed by the Nourse-Watson Machine Works, of Seminole, Okla., for use in connection with the drilling of oil wells. This steel front, one of which is shown in the illustration, is of the portable type and contains 150 welds. The foundation is made of 6-in. drill pipe.

The portable type of structure has the advantage that it can be trucked from one location to another and can be set up for drilling without the expense of setting a concrete foundation, when the well may come in dry.

A portable front of this kind is set on wooden timbers, and then the sand reel and Samson post are bolted in their places. The walking beam is then erected, after which drilling is ready to commence.

Because of the road laws of Oklahoma, it is necessary that the sand reel and Samson post be removable when being moved, owing to their height and width.



This Structure, Made of Pipe, Contains 150 Welds, and Can Be Dismantled for Moving.

What's New in
Equipment and Accessories

Flux for Aluminum and Its Alloys

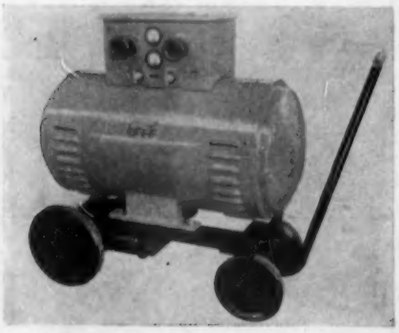
A new flux for welding sheet aluminum and alloy aluminum, known as A. B. C. aluminum flux No. 8, has been developed by the Anti-Borax Compound Co., Fort Wayne, Ind., and is sold in bottles containing ¼, ½ and 1 lb. or in lots of 50 and 100 lb.

High Economy Claimed for "Speed Arc" Welder

Unity-power-factor drive, is the feature of the new Noel "Speed-Arc" welder just announced by The Ideal Electric & Manufacturing Co., Mansfield, Ohio, for which unusually high efficiency is claimed. This welder is also said to produce a fast arc with almost incredible recovery speed. Credit for this performance is given to the unique arrangement of generator windings, utilizing a separate auxiliary differential field structure.

Oscillographs show recovery from short circuit to normal welding current in less than one-hundredth of a second. This welder is said to maintain its current and voltage settings when started up cold and run full load for any desired period.

Both 25- and 40-volt operation is provided by a simple adjustment of the controls, which allows use of the high-speed coated rods as well as bare rods,



New Noel "Speed Arc" Welder.

and metallic-arc and carbon-electrode work, all on the same machine.

Other features of these machines are their all-steel welded construction, dual control system for both voltage and current control, polarity-reversing switch, and zero-center individual current and voltage meters. Drip-proof covers are provided, the removal of which allows easy access to all parts of the unit. An automatic brake holds the welder from rolling when the pulling handle is lifted.

These welders are also available with direct-current drive and engine drive.

Automatic Blowpipe Burns City or Natural Gas

A new automatic blowpipe for heating, annealing and soldering, has been announced by the Weldit Acetylene Co., 641 Bagley Ave., Detroit, Mich. The fuel gas used may be artificial gas, natural gas or butane, with compressed air. The burner is provided with a pilot light. Pressure on the lever allows both gas and compressed air to pass through to the burner. Release of the lever shuts off

Soldering and Annealing Blowpipe.

both gas and air, except sufficient gas to maintain a pilot light. This design, with pilot light, is said to result in a saving of 50% to 75% in gas consumption.

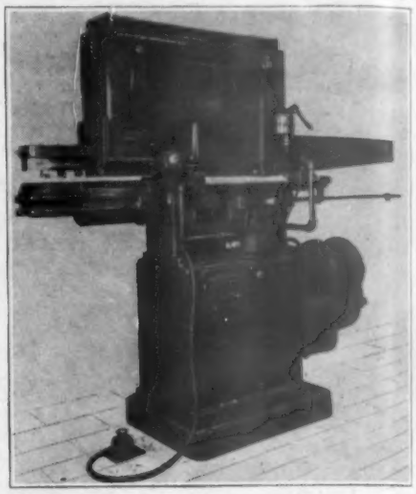
Processed Cover Glass for Welders' Lenses

A crystal-clear processed cover glass for welders' lenses, carrying a guarantee of 200 hours service, was recently placed on the market by the Electro Cover Glass Co., 803 Westinghouse Building, Pittsburgh, Pa.

These glasses are cut to the exact dimensions of 2x4⅛ in. On the processed side is stamped the trade name ECGCO to indicate to the one installing it the side to be exposed to the fused particles. It is claimed that the processed glass will retain its original crystal-clean condition throughout the guarantee period.

Removing Flash From Butt-Welded Steel Rings

A machine for removing the flash from butt-welded steel rings such as automobile wheel rims, has been developed by the Morton Manufacturing Co., Muskegon Heights, Mich. This machine will take a width of seam up to 12 in. and stock thickness from 24 gauge to 3/16 in. It has a variable and return speed from 0 to 65 ft. per minute. Power is furnished by an electric motor driving a hydraulic pump, and is applied to two reciprocating rams by means of hydraulic-operated cylinders. The work is placed between hardened dies, and sufficient pressure is applied through a hydraulic-operated spring-loaded toggle motion to securely clamp the work while trimming. Vertically adjustable ram and



Machine for Removing Flash After Butt-Welding.

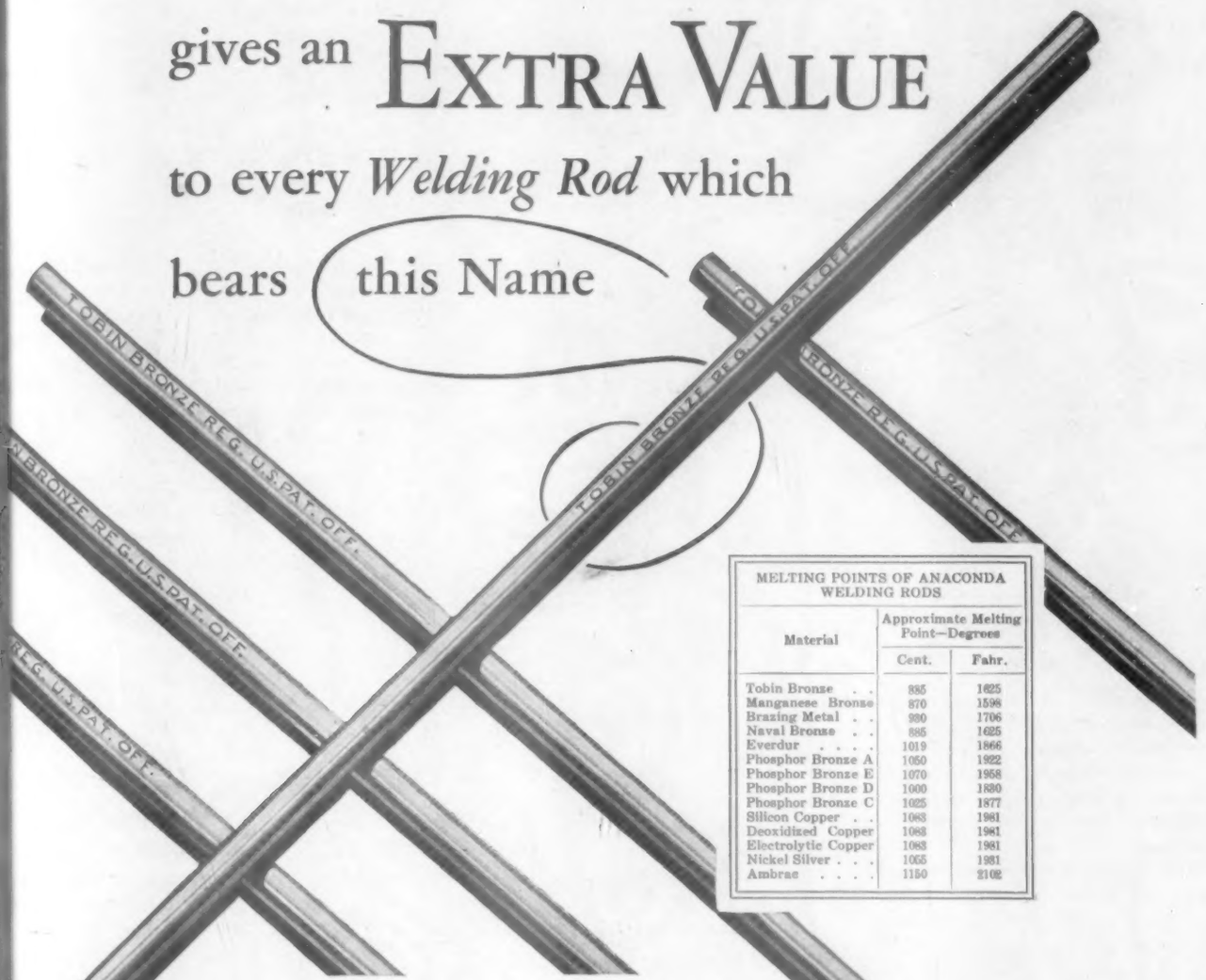
dies automatically take care of the clamping and positioning of the cutters in relation to the work, and automatically compensate for any variation in stock thickness, it is claimed.

The cycle of operation is automatic. As the work is entered, the operator steps on the control button, the machine automatically clamps and starts its cut on the draw-cut stroke, then releases the work at the end of the stroke, and the cutting tools return to the "out" position. Exceptionally high production is claimed for this machine.

Makes Gas for Purging Tanks Before Welding

Tanks containing such common inflammable substances as gasoline and fuel oil cannot explode when being flame-cut or welded if the air space is completely filled with an inert gas. A means for generating such a gas has been developed and patent applied for, by N. E. Koch, of the Koch Welding Works, 2843 Whittier Blvd., Los Angeles, Calif. The gas is pumped into the tank to be welded and, being heavier than air, it forces the air out through the top of the tank. The inert gas can be left in the tank as long as desired and remains effective indefinitely, Mr. Koch claims. Gasoline vapor generated by the welding heat cannot explode, because of the total absence of air, though when it reaches the atmosphere it would burn if ignited.

More than a century of metallurgical experience gives an EXTRA VALUE to every *Welding Rod* which bears this Name



MELTING POINTS OF ANACONDA WELDING RODS

Material	Approximate Melting Point—Degrees	
	Cent.	Fahr.
Tobin Bronze	885	1625
Manganese Bronze	870	1598
Brazing Metal	930	1706
Naval Bronze	885	1625
Everdur	1019	1866
Phosphor Bronze A	1050	1922
Phosphor Bronze E	1070	1958
Phosphor Bronze D	1000	1830
Phosphor Bronze C	1025	1877
Silicon Copper	1083	1981
Deoxidized Copper	1083	1981
Electrolytic Copper	1083	1981
Nickel Silver	1055	1931
Ambrac	1150	2102

WITH so many conditions which you must control in a welding job, why take even the slightest chance on the quality of your rod? The utmost uniformity of Tobin Bronze is maintained by close technical control of the alloy—by the skill and knowledge accumulated during more than a century's experience. That's what we mean by "extra value".

Time-tried Tobin Bronze carries the name stamped every 12 inches in each rod. So, when you ask for "Tobin", look for this mark and make sure you are getting the genuine product.

ANACONDA

NRA CODE

Thousands of experienced welders will accept no other rod for the general oxy-acetylene welding of cast and malleable iron ... locomotive cylinders, automobile engine blocks, cast iron pipes, machinery parts and similar equipment.

THE AMERICAN BRASS COMPANY

General Offices: Waterbury, Connecticut

Offices and Agencies in Principal Cities

In Canada: ANACONDA AMERICAN BRASS LTD., New Toronto, Ontario

ANACONDA WELDING RODS

Commercial News

Fort Wayne Supply House Holds Welding Clinic

The Wayne Welding & Supply Co., of Fort Wayne, Ind., held a welding "clinic" in their shop on the evening of Jan. 7th. The roll call reached nearly the hundred mark, and high interest was shown. James ("Red") McClure plans to hold "clinics" such as this one once a month, during which his place of business will be turned into an experimental shop for his friends and customers.

At the Jan. 7th "clinic," a very interesting and instructive paper, together with motion-picture films, on pipe welding, was given by Earl M. Evleth, development engineer, The Bastian-Blessing Co., Chicago. "Red" gave a short talk on bronze welding of cast iron, which was followed by a demonstration of pipe welding and of bronze welding on cast iron.

Maurath in Production Two Weeks After Fire

On Dec. 23rd, at 5 a.m., the plant of Maurath, Inc., at 3139 Croton Ave., Cleveland, Ohio, was swept by a disastrous fire. The interior of the plant was completely gutted, and about $50,000 damage was done to the plant equipment and stock.

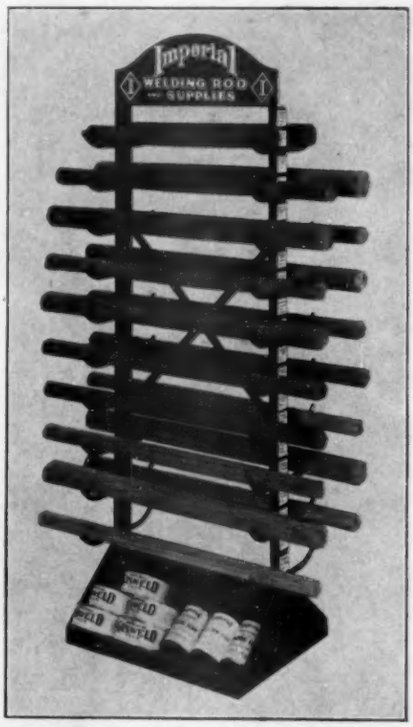
"The A. D. T. System functioned," reports "Whitey" Maurath, president of the company, "and I was routed out of bed and arrived at the fire in the thick of it. I got the battalion chief to center his efforts on the main equipment from being a total loss. A temporary structure was immediately built over the salvaged equipment and the plant was able to produce on the seventh of January to take care of our customers' wants. I want to thank my customers and friends for their hearty cooperation while the plant was temporarily out of commission."

Torchweld Resumes Payment of Stock Dividend

A dividend of $3.00 per share on stock of the Torchweld Equipment Co., Chicago, was declared on Jan. 2nd by the officers, C. K. Anderson, president; J. C. Kirchner, vice-president; and J. L. Jensen, secretary-treasurer and general manager. This is the first dividend paid since the death in 1932 of W. A. Slack, formerly head of the company. The present officers of the company have been serving since Jan. 26, 1933; and on June 1, 1933, the company moved to larger quarters at 1035 W. Lake St.

Display Rack for Welding Rods and Fluxes

A display rack of welded steel is being given to their jobbers who purchase a certain minimum amount of welding rods, by the Imperial Brass Manufacturing Co., 522 S. Racine Ave., Chicago, Ill. This rack enables the rods to be



displayed to good effect, and shows at a glance the wide variety of welding rods being offered. Welding fluxes are displayed in the base of the rack. The jobbers have shown a keen interest in this novel method of display welding rods, it is reported.

The Globe Machinery & Supply Co., Des Moines, Iowa, who, according to an announcement from Harris A. Goodwin, district manager for The Bastian-Blessing Co., are authorized distributors in central Iowa for "Rego" welding and cutting equipment, has added Wallace Henry to their sales force to direct the activities of the newly formed welding department. Mr. Henry, who is a graduate of Iowa State College, has been interested in the practical application of welding for the past several years.

The Process Plow Welding Co., of Perry, Iowa, are establishing a truck delivery route that will cover the state of Iowa, and are also sending out four salesmen to travel the surrounding territory. Reclaiming units for old plowshares and other farm implements, as well as welding rods and supplies for electric welding, will be handled.

The St. Louis Oxygen Co. has moved to a new plant and offices at 1520 S. Vanderventer Ave., St. Louis, Mo., and in the future will operate under the name of the National Cylinder Gas Co., which more accurately describes the business, which embraces oxygen, acetylene, hydrogen, nitrogen and other gases sold and delivered in cylinders.

Synchronized Electric Welders is the name of a new concern in Perry, Iowa, formed by Laurence Heightshoe, who has purchased the interest in this device formerly held by the New Process Plow Welding Co. The latter company report that they have no connection with the new concern.

The Logansport Oxygen Co., Logansport, Ind., is beginning its 23rd year of service to the welding and cutting trade in Indiana, Michigan and Ohio, and in the future will operate under the name of the National Cylinder Gas Co.

Ira B. Yates is now associated with the Wilson Welder & Metals Co., Inc., and is located at the main office and factory at North Bergen, N. J., where he is assisting is sales work. Mr. Yates formerly was with the Chicago office of the Bryant Machinery & Engineering Co.

"Amsco" nickel-manganese welding rods and a general line of hard-surfacing materials are now being distributed by the McLean Welded Products Co., 530 West 79th St., Chicago, Ill. Brinell numbers from 479 to 700 are claimed for the hard-surfacing rods.

C. M. Fauer has been added to the sales force of the Air Reduction Sales Co. and is working out of the Cincinnati office, in the Dayton district. Mr. Fauer was formerly with Joseph T. Ryerson & Son, Chicago, and at one time had a welding shop in Bremen, Ind.

A St. Louis, Mo., office, at 1010 Pine St., has been opened by Revere Copper and Brass, Incorporated, Dallas Division, of Chicago. Edward A. Harbeck is St. Louis district manager.

The Industrial Supply Co., of Terre Haute, Ind., and of Brazil, Ind., has been appointed distributor of welding and cutting equipment by the Torchweld Equipment Co., of Chicago.

Ralph Kittle, formerly with the Sight Feed Generator Co., has joined the Wayne Welding & Supply Co., of Fort Wayne, Ind., as salesman.

Cut Your Welding Costs

A LARGE user of electrodes (name on request) made some private tests before he adopted Gulfsteel electrodes exclusively... Two 8-inch spaces were marked off on a tank in process of welding; one space was welded with their regular rod, the other with a Gulfsteel rod. The weld with the Gulfsteel rod required 41 seconds less time, with 4½ inches of the Gulfsteel rod left, as compared with only 1½ inches of the regular rod left over... Other tests have confirmed these savings in time and material, *and with a superior weld*... Write today for samples and prices... Inquiries from distributors are invited.

GULFSTEEL

GULF STATES STEEL COMPANY
BIRMINGHAM, ALABAMA

with GULFSTEEL Electrodes

Quick • Simple • Positive **FLIP FRONT**
in the new Willson Welding Helmet No. 300

The comfortable, adjustable headgear in the new Willson Helmet No. 300 holds the helmet in three positions by use of a four-sided drum which turns within a substantial saddle spring and holds each position positive.

The glass holder is molded of a fine grade plastic composition which will not warp or bend. It is not a conductor of electricity and is unaffected by moisture or extreme temperatures. Glass replacement is simple and quick.

The outer section of the glass holder with filter and clear cover glass, flips up instantly for weld inspection. Another clear glass in the stationary section protects the welders' eyes on hot, spattering jobs.

Willson-Weld Glass used in this helmet meets with Standard Specifications for the protection of eyes from harmful rays emanating from welding operations.

Made of a more durable black fibre in improved design with riveted construction, No. 300 is a sturdy helmet and can stand a lot of shop use and abuse.

If you are a welder who takes pride in turning out a good job, you know that the quality of your work depends in a large measure on the worth of the tools you use. Send for completely illustrated folder descriptive of No. 300 Helmet. It will help you form an opinion of the value of this helmet's several exclusive features.

WILLSON PRODUCTS, Inc.
Reading, Pa.

Sylvester A. Mahan was recently appointed works manager of the Philadelphia plant of the Edward G. Budd Manufacturing Co., and Joseph W. Meadowcroft, assistant works manager.

R. A. Merritt, formerly of the Chicago office of the Air Reduction Sales Co., has been promoted to assistant sales manager of the company's Birmingham, Ala., office.

Notes From the Field

Temporarily, at least, for the C. F. Braun Co., of Alhambra, Calif., the depression seems to be over. Three full 8-hour crews of welders are now employed by the company on a number of orders for refinery and other equipment for oil companies in the Mid-Continent oil field. Reports are to the effect that the full-time program will continue for several months.

The Consolidated Steel Corp., of Los Angeles and San Francisco, has been awarded a large welding contract by the U. S. Reclamation Department, the contract calling for 20,000 ft. of 80-in. welded pipe for use on the Malheure Siphon, a portion of a large government project in Oregon. The joints of this pipe will range from 24 to 36 ft. in length.

The Vickers Machine Works, of Oklahoma City, Okla., was recently purchased by Howell and Parks, who have moved the business to Ada, which is in the booming oil field of the state. The business will be operated under the name Howell & Parks Machine & Welding Works.

A night class in oxyacetylene welding was recently organized in the Manual Arts Department of the Pasadena (Calif.) Junior College. About 20 students are enrolled in this extension training course, which is being given under the supervision of T. A. Hawley.

The Advance Welding Works, of Los Angeles, Calif., until recently located at 1815 E. Washington Blvd., has been moved to 1627 Alameda Blvd. Equipment is being installed for the manufacture of tanks under the State Code specifications. O. C. Temple is owner.

The Standard Oil Co. of California recently awarded a contract for the construction of six 138,000-barrel welded steel storage tanks at Estero Bay, the western terminal of the company's Rio Bravo pipeline, which is now under construction.

The Superior Welding Co., John Holthaus, proprietor, formerly located at the corner of Russell and Grand Blvd., East Detroit, Mich., has moved to 6538 Russell, into a larger and much better equipped shop.

A 400,000-volt x-ray installation was recently put in operation at the Chicago Heights (Ill.) plant of the American Manganese Steel Co., for examining castings of manganese steel and chromium-nickel alloy.

C. B. Taylor, on Jan. 1st, resigned as superintendent of The American Tank & Equipment Co., of Oklahoma City, Okla., subsidiary of Black, Sivalls & Bryson. It is understood that the vacancy has not yet been filled.

Nourse-Watson, of Seminole, Okla., recently reorganized and changed the name of the firm to Woods-Watson. M. L. Rogers was awarded a contract to do their welding.

Snitcher & Pitman, of Oklahoma City, Okla., are doing a very nice business building portable rotaries by welding.

· CLASSIFIED ADS ·

Help Wanted—75c per line, minimum 4 lines. Jobs Wanted—4 lines free. Other Ads—$1.00 per line, minimum 4 lines. Count 8 words to line. Add 6 words for keyed address.

Bargains—Demonstrator Arc Welders. Gasoline, electric drive, belted, or coupled-together outfits. 30 days' trial. Easy terms, if desired. Write Ken's Welding Exchange, Box U-151, Troy, Ohio.

Bargains—Five 300-amp. Buda-engine-driven Lincoln welders. Completely overhauled. Also Wilsons and others in stock, for sale or rent. Guaranteed. Service Co., 3741 Cedar Ave., Cleveland, Ohio.

Fly Ball Governors—Adapted to all makes of auto engines; belt driven, flat or V. Price, $6.50 prepaid. Satisfaction guaranteed. In ordering state style of belt. Wm. D. Alber, Beatrice, Nebr.

EVER-KLEAR COVER LENS

Are shielded with a coating that repels molten metal sparks; will not pit. Also acts as an insulator. Unobstructed vision insures faster and better welds. Guaranteed 200 welding hours. Size 2 x 4¼", packed one dozen to the carton @ $2.40 per dozen

Order direct or through your dealer.

F. R. FAULK, 50 Penn Ave., Pittsburgh, Pa.
Exclusive Distributor

Office Man and Welder—Sales demonstrating and maintenance-welding experience. Thorough accounting training and cost-accounting experience. 28 years of age. Single and unemployed, with ambitions of changing both conditions. Am capable at acetylene brazing, "long arc" copper welding, and estimating. Address Ja-1, The Welding Engineer.

Aggressive Combination Welder—Desires employment on construction work in foreign country. Age 23, four years' experience in job shop and factory. Can furnish best of references. Howard Coryell, care of Monarch Welding Co., Brush St. at Voernor Highway, Detroit, Mich.

Competent Acetylene and Electric Welder—18 years' experience in welding locomotive boiler fireboxes and appurtenances, frames, cylinders, and pipe welding. Also experienced in job and shop welding. Age 37. Glen Hull, care of Harold Winfield, 813 Ave. E, Council Bluffs, Iowa.

Superintendent-Manager—10 years' experience, layout, estimator, welding foreman, shop superintendent, designing. Sheet and plate contract shop. Familiar with all classes of arc welding. Address Ja-2, The Welding Engineer.

Combination Welder—Many years' experience handling both arc and gas. Wm. H. Dietrich, 960 Exeter Ave., Exeter Borough, Pittston, Pa.